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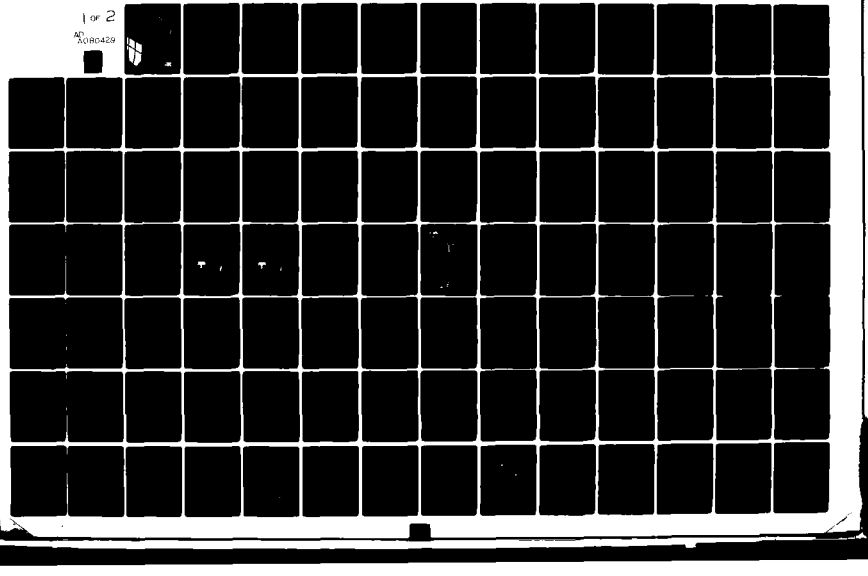

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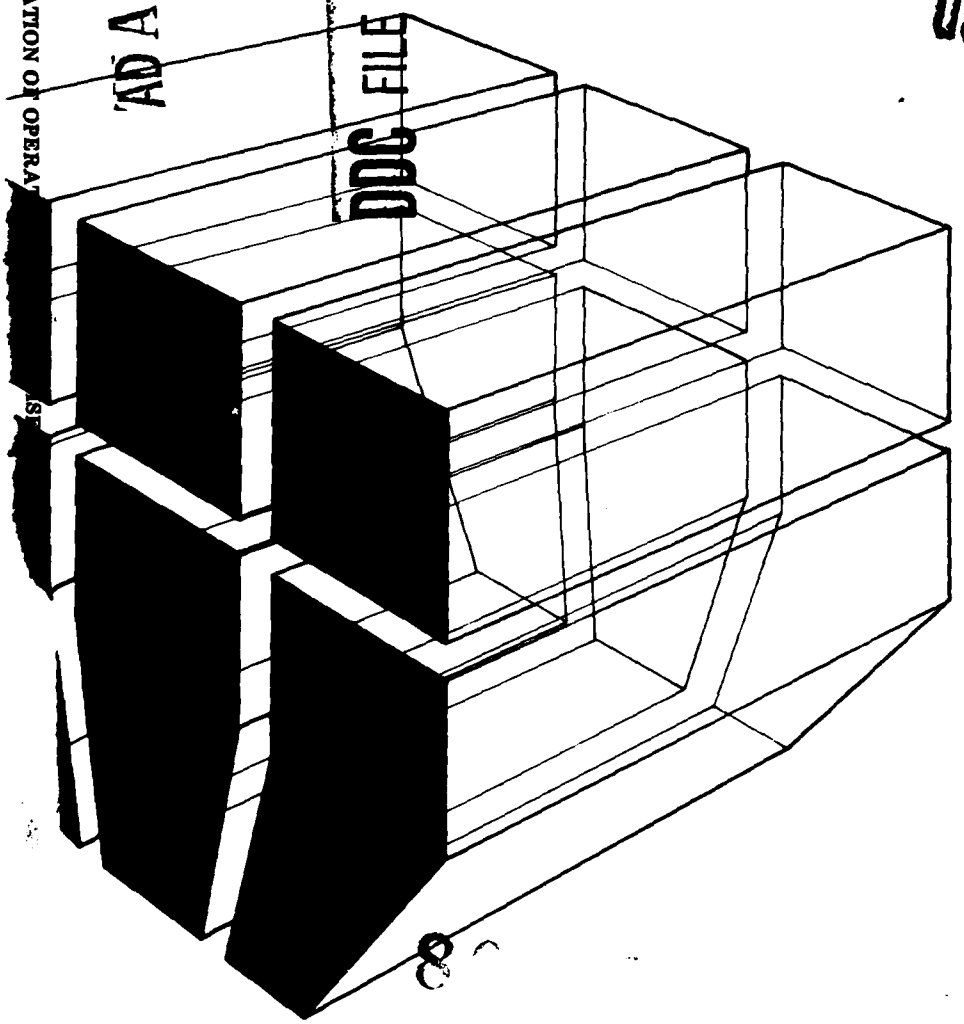
TECHNICAL REPORT N-82
January 1980

LEVEL II

COMPILATION OF OPERATIONAL BLAST NOISE DATA

by
J. McBryan



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This report presents the means for acquiring operational blast noise information to produce L_{dn} annoyance contours. Forms introduced and explained to facilitate the compilation of data include the Target Data Sheet, Firing Point Data Form, and Attachment Sheet. Overlays to be constructed in order to evaluate the contours consist of generalized land-use and population density map overlays.

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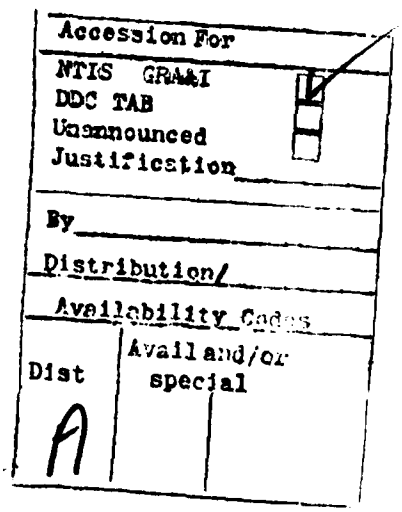
FOREWORD

This research was conducted for the Directorate of Military Programs, Office, Chief of Engineers, under Project 4A762720A896, "Environmental Quality Technology"; Task A, "Environmental Impact Monitoring Management Assessment and Planning"; Work Unit 011, "Development of the Integrated Installation Noise Contour System (INCS)." The applicable QCR is 3.01.007. Mr. Frank Beck, DAEN-MPE-I, was OCE Technical Monitor.

The work was performed by the Environmental Division, U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, IL. Dr. R. K. Jain is Chief of EN.

COL L. J. Circeo is Commander and Director of CERL and Dr. L. R. Shaffer is Technical Director.



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FIGURES (Cont'd)

FIGURES (Cont'd)

FIGURES (Cont'd)

COMPILATION OF OPERATIONAL BLAST NOISE DATA

1 INTRODUCTION

Background

Blast noise is a problem at military facilities and their surrounding communities. The noise from such activities as armor, artillery, and demolition interferes with normal human activities in schools and housing areas by disrupting communication and thought processes, interfering with sleep, and causing tension. TM 5-803-2 provides guidelines for locating noise-sensitive land uses on-post; blast noise contours are used to identify areas which are incompatible with these land uses. AR 210-20 provides for an orderly, cooperative planning process with the off-post community in order to minimize off-post, noise sensitive land uses in noise-impacted areas. As with on-post planning, blast noise contours depicting the impact of such activities as armor, artillery, and demolition are part of the planning process. AR 210-20 actually provides for installation-compatible use zones (ICUZ), which are an outgrowth of the DOD Air Installation Compatible Land Use Zone (AICUZ) program. The Army program recognizes that while the major noise sources DOD-wide may be aircraft, the major Army noise sources include armor, artillery, as well as aircraft and small arms. Blast noise contours also represent some of the information which can be used in developing a facility's environmental impact assessment or statement.

The primary purpose of noise zone maps is to assist in an orderly planning process, both on- and off-post. Currently, new noise-sensitive land uses are built in noise-impacted zones around Army bases, Army-wide, at the rate of greater than 4 acres per day. Figure 1 depicts a typical blast noise zone map; Figure 2 depicts a typical generalized land use map for the base and its surrounding area; and Figure 3 depicts the noise zone map overlayed on the generalized land use map. The incompatible areas are readily identified and depicted in Figure 4.

Objective

The objective of this report is to instruct installation personnel on how to gather operational information required for predicting the impact of blast noise in a suitable format so that it can be readily keypunched and a computer prediction made of the noise impact.

Scope

This report contains information necessary for gathering operational data for predicting the noise impact of artillery, armor, mortars, grenades, small rockets, explosive ordnance disposal, demolition operations, and any blast-like (impulse noise producing) event. Quarry operations with multiple blasts and their resulting, directed shock waves are not covered. Base personnel involved with activities which produce this type of shock wave should contact the U.S. Army Construction Engineering Research Laboratory (CERL) before beginning any noise impact analysis. Users should read this entire report before attempting to gather any operational data.

Overview and Organization

Two basic forms are required to develop and list the operational blast data: the Target Data Sheet and the Firing Point Data Form, which are described in Chapters 2 and 3, respectively. Noise contours are developed by adding up all the noise produced by the various sources. In the case of armor or artillery, there are normally two sources: the firing of the gun and the impact of the shell. The Target Data Sheet and the Firing Point Data Form serve to catalog the necessary operational data, which includes the location at which the gun is fired, whether the firing is during the day or night (noise at night is more disturbing), the size of charge used to fire the gun, and the target where the shell impacts. Because both the firing point and the target are coupled together, the direction of fire is known and the directivity pattern of the gun's noise can be accounted for.

Numerous examples from different types of facilities are used to clarify the procedures for filling out these forms. Each installation presents unique setup problems to the individual required to submit data. On some installations, it may be difficult to determine the firing points; on other installations, data in the target areas may be difficult to derive; and on yet others, the number of rounds fired or charge sizes may present the major data deficiency. Chapters 2 and 3 contain examples that typify these problems and explain some of the solutions to them.

Chapter 4 tells how to submit data in order to obtain L_{Cdn} equal annoyance contours. These maps are obtainable to any scale and the chapter describes how to obtain different scales, special options which are available to the user, and the attachment sheet which goes with the data submission to indicate what general information is required. Chapter 5 offers a brief summary of the procedures explained in chapters 2 and 3, and the appendix explains how to fill out recommended site forms.

Normally, a minimum of 4 months of data, 1 month from each quarter of the year, will be required to complete the Target Data Sheet and

Firing Point Data Forms. If there is a large variation in operations, up to 12 months of data on firing activity may have to be considered at the time that the data forms are being completed. (A large variation is a 40 percent or more change in operations between different months of any quarter. If there is a large variation between quarters, CERL should be consulted before work is begun.)

Mode of Technology Transfer

The methods described in this report will be published by the Department of the Army (DA) as a technical bulletin; the program and documentation for the BNOISE computer contours system will be available from the Department of Army Assigned Responsible Agency (1980).

2 COMPLETING DATA SHEETS

A Target Data Sheet, shown in Figure 5, is used to list all the targets at a base. The columns on the sheet correspond to IBM card columns. The following paragraphs describe the data entered into the various columns of the form; column 1 will be discussed at the end of this section.

Columns 2 Through 5, Target Identification

Target data is usually obtained at the Range Control Office. Sometimes it is necessary to talk with individual Battery commanders to determine their "favorite" targets such as hills or old, wrecked vehicles. Chapter 3 describes other methods of determining target locations. When the total number of targets is less than 25, the identification number for each target is entered onto the Target Data Sheet. However, when the number of targets exceeds 25, they are grouped into target areas and each target area is assigned a unique identifier of up to three alphanumeric characters (numbers, letters, or both). Figures 6 and 7 show bases with small and large numbers of targets, respectively.

Less Than 25 Targets

When the number of targets is this small, the target identification code is copied directly from a map of the area or from the base Table of Metric Grid Coordinates and entered into columns 2 through 5. Figure 8 shows a map with eight targets and one firing point. Figure 9 shows what the Target Data Sheet should look like when all the target identification codes are copied onto it from Figure 8.

More Than 25 Targets

With a large number of targets, circles are drawn to group the target points into clusters. Also, if there are no surveyed targets (such as car bodies or old armored personnel carriers) a similar procedure should be followed to completely cover the target impact area with circles of appropriate radii. (The target impact area is the area where most of the rounds can be expected to land. The whole impact area does not have to be covered with circles, just the area where the rounds land.) This procedure involves drawing a 1/2, 1, or 1 1/2 km-radius circle around most of the points that are clustered together in a target area. Although a 1 1/2 km circle makes identification easiest, it may be necessary to plot all the individual targets in order to develop appropriate groupings. Figure 10 illustrates this process. Choosing the groupings before identifying the individual targets might have led to inappropriate closing as illustrated in Figure 11.

If a major population center (city, town, or village) or base housing (Bachelor Enlisted Quarters, Bachelor Officers Quarters or Family Housing) is near, the radius of a circle must not exceed one-fifth of the distance between the population area and the center of the circle. More circles of a smaller radius are to be drawn instead of just one 1 1/2 km circle.

An alphanumeric identifier of up to three characters is arbitrarily assigned to each target grouping. This identifier must be unique since it will be used later to identify a particular target group.

Figure 12 illustrates the grouping of target points when they are close to a housing section. Note that two circles, each of 1 km radius, are drawn. In Figure 13 the lower grouping of targets is near the housing area, so several circles are drawn. The upper circle in Figure 13 was totally removed from any population center and was drawn to the largest size possible.

In Figure 14 the identification column for the Target Data Sheet has been completed for Figures 12 and 13. Great care must be exercised to make certain that only one target corresponds to a given target identification number.

Figure 15 illustrates circles drawn throughout the target impact area to completely fill in the area where rounds can be expected to land. Notice that the range officer has blocked off a smaller area inside the artillery impact area to be used as the target impact area. Also notice that target 3 has been drawn to a larger radius since it is farther away from noise-sensitive land uses than targets 1 and 2, but that the radii of targets 4 and 5 have been kept small in order to follow the outlines of the target impact area.

Columns 7 Through 12, X Coordinate; and Columns 13 Through 18, Y Coordinate

Targets Not Grouped

This information is obtained either from a map or from the installation's Table of Metric Grid Coordinates for target points. Enter the X coordinate (east-west) in columns 7 through 12 and the Y coordinate (north-south) in columns 13 through 18.

The map is easiest to use if one is familiar with the area. Coordinates are given to the nearest 100 m. For example: consult Figure 16 to read the X and Y coordinates of target point 747. It can be seen that the X coordinate of 747 is between 25 and 26. Twenty-five and 26 are the large numbers running from west to east found at the bottom and in the body of the map. Notice from the circled X and Y coordinates at the lower left-hand corner of Figure 16 that the large numbers are in

units of 1000 m. From estimation, or by using a plastic grid overlay calibrated to the map scale, read a digit for the 100's place in Figure 17. This digit is 5 since point 747 is five-tenths of the way across the grid. In this case the X coordinate entered in the Target Data Sheet is 25500. The Y coordinate is read similarly (Figure 18). Notice that the point 747 is between the Y coordinates of 35 and 36. By estimation or measurement the next digit is 9 since the point is nine-tenths of the way up the grid as shown in Figure 18. The Y coordinate entered in the Target Data Sheet is 35900. The Target Data Sheet filled out as read from the map is indicated in Figure 19.

The installation's Table of Metric Grid Coordinates for target points is used if the person gathering data is unfamiliar with the location of the target. Values in this list are stated to the nearest meter and no rounding is required. When reading from the installation's Table of Metric Grid Coordinates for target points, the last five digits correspond to the Y coordinate (see sample, Table 1). The Target Data Sheet is completed in Figure 20 from the installation's Table of Metric Grid Coordinates for target points.

Table 1

Table of Metric Grid Coordinates (Target Sample)

Tgt no	Grid reference		Alt (meters)	Location	Description
745	25782	35849	445	POA	Yellow car body
746	25937	35476	440	POA	Orange car body
747	25499	35894	438	POA	Orange car body
748	25215	35666	433	POA	White car body
749	25086	36496	443	POA	Yellow car body

Targets Grouped

After the targets have been grouped and circles drawn, the coordinates are read directly from the map. The location of the target area is the center of the circle. Enter 5-digit coordinates from the map for each circle group on the Target Data Sheet. A review of map reading was discussed in the preceding section, and illustrated in Figures 16, 17, and 18. Figure 21 is an example of how to read coordinates from a map with 1 km circles. The X and Y coordinates are completed in the Target Data Sheet shown in Figure 22. (Note: In some cases it is necessary to use all six digits because the base is on a division of major zones. That is, if the X coordinate of one target is 591500 and another target is 608400, then all six digits are used.)

Column 1, End of Target Data Flag

After filling out the Target Data Sheets for all the targets, place an asterisk in column 1 of the last entry on the Target Data Sheet. This indicates the end of the target data. Figure 23 shows a Target Data Sheet with an asterisk on the same line as the final target entry.

3 FIRING POINT DATA FORM

General

This form is used to list all the activities at firing points or demolition sites. Figure 24 illustrates the Firing Point Data Form. The columns on the sheet correspond to IBM card columns. The following paragraphs describe the data entered into the various columns of the form; column 1 will be explained at the end of this discussion.

When completing this data, one or more forms are used for each firing point. The Firing Point Data Form is to be completed in pencil because some decisions have to be made later which require erasing. It is easier to complete the forms if the range records are arranged in chronological and numerical order. For additional sheets, cross out the boxes at the top of each continuation sheet.

The standard practice of going through the records is to take one day at a time. That is, go through the data in chronological order and take one firing log at a time. Add this data to the appropriate Firing Point Data Form. If no Firing Point Data Form has been started, a new identification number is created and the data entered. The next line on the Range Control Log is then consulted and the process continued.

For installations which have a small number of surveyed firing points, a more efficient means of compiling the necessary data is to start a Firing Point Data Form for each firing point. The person gathering the data can then "leaf" through the range records in order to find all data for that particular firing point, crossing off the firing points as the data is transcribed. This process is continued for all the firing points. After reading Chapter 3, persons gathering the data will be able to decide which of the above two procedures is preferable.

The Box Above Columns 2 Through 5, Firing Point Identification

To begin, the identification number of firing points is read directly from appropriate range records such as the Range Safety Card, the Range Control Log, the Range Request Form, or a site form (see p 30, Recommended Data Gathering Technique), and entered in columns 2 through 5.

If a firing point has a direction letter following the identification number, this letter is entered in the box above column 6.

Unlike target points, firing points are not grouped into circles.

Demolition sites are not usually numbered on the map, so the person gathering data must create an unused identifier and assign it to demolition sites in order to avoid confusion. Designations such as D1, D2, or EOD3 are recommended. As an example, Figure 25 shows several demolition sites that have been arbitrarily identified with unused labels.

The Box Above Columns 7 Through 12, X Coordinate; and Columns 13 Through 18, Y Coordinate

Information for these columns is obtained from the daily range records, the installation's Firing Points Listing, or the base reservation map. Enter the 5-digit X coordinate in columns 7 through 12 and the 5-digit Y coordinate in columns 13 through 18. These coordinates can usually be rounded to the nearest 100 m, but if noise-sensitive land uses lie within 500 m, greater accuracy (i.e., rounded to 10 m) is required.

Coordinates may be read from the installation reservation map if desired or if the range records do not include this data. An example of how to read a location from a map was given in Chapter 2 and in Figures 16, 17, and 18. For firing point 115 (see Figure 26), the X and Y coordinates are read from the map and entered in the appropriate columns. Figure 27 shows the corresponding Firing Point Data Form.

If desired, coordinates may be found in the installation's Table of Metric Grid Coordinates for firing points, but they have to be truncated to the nearest meter in order to be consistent with the data sheet. Table 2 is an example of an installation Table of Metric Grid Coordinates for firing points. From Table 2 the X coordinate for firing point 115 is 550646.8. Truncate this number to 550646 and enter the last 5 digits (50646) into the Firing Point Data Form. The completed Firing Point Data Form entry is shown in Figure 28 for both the X and Y coordinates. (Note: In some cases it is necessary to use all six digits because the installation is on a division of major zones. That is, if the X coordinate of one firing point is XY90700, and another firing point is XZ01700, then all six digits are required.)

Table 2

Table of Metric Grid Coordinates (Firing Point Sample)

Station	Coordinates	Azimuth (mils) Altitude (meters)
FP 112	(550967.6 - 836772.3)	376
FP 113	(550810.3 - 837006.5)	372
FP 115	(550646.8 - 837717.2)	369
FP 115 N	(550622.2 - 837781.1)	368
FP 115 S	(550646.8 - 837647.3)	369

Columns 19 and 20, Weapon Type

The weapon type is entered in columns 19 and 20. The weapon type can be found in the range records. Multiple records, if available, should be used to double-check the data to minimize error. One firing point can have two or more types of weapons on any given day. As can be seen from the example of a Range Safety Card in Figure 29, the weapon type for Firing Point 115 is an 8-inch howitzer.

After the weapon is known, consult Table 3 and enter the one- or two-digit weapon code in columns 19 and 20. If the weapon is not listed in Table 3, assign the next code number (15, 16, 17, or 18) to the weapon and include this information on the attachment sheet as explained in Chapter 4, Figure 64. Figure 30 shows how to enter the codes into the Firing Point Data Form.

Columns 29 and 30, Minimum Charge; and Columns 31 and 32, Maximum Charge

Consult columns 19 and 20 on the Firing Point Data Form. If the weapon type code in columns 19 and 20 was any number but 10 or 11, follow paragraphs 1, 2, or 3 below. If the weapon type was 10, follow paragraph 4 below; and if the weapon type was 11, follow paragraph 5 below.

1. Weapons Charge Size Given in Range Records Card. Refer to the records and enter the number after "Minimum Charge" in columns 29 and 30 and the number after "Maximum Charge" in columns 31 and 32. In Figure 31 the minimum charge is 1, which is entered in column 30 in the Firing Point Data Form. From Figure 31 the maximum charge is 5, which goes in column 32. Note that single-digit numbers go only in columns 30 or 32. The completed Firing Point Data Form for this example is displayed in Figure 32.

2. Typical Weapons Charge Known. If the typical charge is known, enter the value in both columns 29 and 30 and columns 31 and 32. Figure 33 shows the Firing Point Data Form when the typical charge is known to be 5.

3. Weapons Charge Unknown. The charge for this case will be found in the process of determining the correct target group and will be covered below in Target Identification. Basically, the charge range and target identification are estimated as a matched pair after detailed discussions with range personnel, Battery commanders, and firing teams.

4. Small Charge of C4 or Other Explosive (Code 10). For a small charge (0.25 to 99 lb) consult Table 4 to determine the charge code. Enter the charge code in both columns 29 and 30 and columns 31 and 32. Figure 34 shows the completed Firing Point Data Form for a 10-lb charge; the small charge is entered on line 1. (Note: The number of blasts is

Table 3

Weapon Codes

Weapon	Code
105-mm howitzer (M102)	1
155-mm howitzer (M109)	2
8-inch howitzer (M110)	3
175-mm gun	4
155-mm howitzer (M109A1)	5
155-mm howitzer (M114)	6
8-inch howitzer (M110A1)	7
	o
	o
Small charge TNT (0.25 to 90 lb)	10
Large charge TNT (110 to 500 lb)	11
	o
	o
60-mm mortar	20
66-mm mortar	21
81-mm mortar	22
4.2 inch (107-mm) mortar	23
	o
	o
57-mm recoilless rifle	30
90-mm recoilless rifle (M67)	31
106-mm recoilless rifle (M40)	31
	o
	o
20-mm gun	40
40-mm gun	41
57-mm gun	42
90-mm gun	43
105-mm gun	44
152-mm gun (Sheridan)	45
	o
	o
2.75-inch rocket	50
3.5-inch rocket	51
66-mm rocket	52
LAW missile	53
TOW missile	54
Dragon missile	55
Shillelagh missile (from 152-mm gun)	56
35.5-mm rocket	57
	o
	o
40-mm grenade launcher	60
M79 rifle grenade	61
M67 hand grenade	62
Rifle grenade (NATO G839)	63
	o
	o
	o
M60 tank (105-mm)	90
M68 tank (105-mm tank gun)	91
M135 165-mm CEV	92

more important than the size of the blast. Therefore, be very careful whether 50 lb of charge actually represents one 50-lb blast or fifty 1-lb blasts.)

5. Large Charge of C4 or Other Explosive (Code 11). For a large charge of TNT (100 to 500 lb) consult Table 5 to determine the charge code used. Enter this code in both columns 29 and 30 and columns 31 and 32. Figure 34, line 2, shows the completed Firing Point Data Form for a 230-lb charge. (Note: For charge weights in excess of 500 lb, CERL personnel should be consulted before beginning any analysis.)

Columns 21 Through 24, Number of Rounds per Day; and Columns 25 Through 28, Number of Rounds per Night

(Note: The remaining columns on the Firing Point Data Form must be completed in pencil since some adjustments may have to be made after beginning.)

General Directions

Again, range control records may be the main sources of information for filling in these columns. From the Range Control Log in Figure 35 under "Actual Time (In/Out)," it can be seen that this column gives the time period during which firing occurred. (By definition, day occurs between 0700 and 2200 hours while night is between 2200 and 0700 hours.) Find the correct row under "Firing Point/Grid" in the Range Control Log for the firing point under consideration and follow the directions in the appropriate paragraph below:

Fire Occurring Entirely During Day (0700 to 2200 Hours)

If no overlapping occurred between day and night, simply enter the number of rounds fired from the Range Control Log in columns 21 through 24. Skip over columns 25 through 28 since no fire occurred during the night. The example of a typical Range Control Log shown in Figure 36 indicates the firing point, actual time firing occurred, and rounds fired. Figure 37 shows the completed Firing Point Data Form.

Fire Occurring Entirely During Night (2200 to 0700 Hours)

If no overlapping occurred between night and day, skip over columns 21 through 24 since no fire occurred during the day. Enter the number of rounds fired from the Range Control Log in columns 25 through 28. Figure 38 shows a Range Control Log for fire entirely during the night. Figure 39 is an example of the completed Firing Point Data Form.

Table 4

Charge Codes for a Small Charge of C4 or Other Explosive
(The user should choose the code closest to the actual weight.)

Weight of C4 (lb)	Charge Code
0.25	1
1.00	2
5.00	3
10.00	4
15.00	5
25.00	6
35.00	7
50.00	8
70.00	9
90.00	10

Table 5

Charge Codes for a Large Charge of C4 or Other Explosive
(The user should choose the code closest to the actual weight.)

Weight of C4 (lb)	Maximum Charge Code
110	1
140	2
170	3
200	4
240	5
280	6
330	7
380	8
440	9
500	10

Fire Overlapping Between Day and Night

Computation is required if firing is continuous during day and night. This allows the person gathering data to split the total rounds fired proportionately between the hours of firing that occurred during the day and night. When the total number of rounds is divided, the number of rounds per day is entered in columns 21 through 24 and the number per night in columns 25 through 28 of the Firing Point Data Form. Note that the total of the numbers in columns 21 through 24 and those in columns 25 through 28 should equal the total rounds fired as originally read from the Range Control Log. The Range Control Log in Figure 40 shows that the "Actual Time" is split between the day and night. When this occurs, the following steps are followed:

1. Find the number of hours during the day (0700 to 2200 hours) that firing occurs. Round this number to the nearest half hour if necessary.

Example:

Actual Time	
In	/ Out
0500	1100

1100 hours - 0700 (start of day) =
4 hours of firing during the day

2. Find the number of hours in the night (0000 to 0700 or 2200 to 2400 hours) that firing occurs. Round this number to the nearest half hour if necessary.

Example:

Actual Time	
In	/ Out
0500	1100

0700 (start of day) - 0500 hours =
2 hours of firing during the night

3. Total the number of hours in which firing occurred during the day and night from above.

Example:

4 hours (day) + 2 hours (night) = 6 hours (total)

4. Make fractions for day and night hours. To do this for the day, make a fraction of the number of hours in the day that firing occurs over the total hours; i.e., Step 1 divided by Step 3. Similarly, for the night hours, make a fraction of the number of hours in the night that firing occurs over the total hours; i.e., Step 2 divided by Step 3.

Example:

$$\frac{\text{4 hours (day)}}{\text{6 hours (total)}} = 2/3 \text{ (day fraction)}$$

$$\frac{\text{2 hours (night)}}{\text{6 hours (total)}} = 1/3 \text{ (night fraction)}$$

5. Multiply the day fraction times the total number of rounds fired from the Range Control Log, round to a whole number, and enter in columns 21 through 24 of the Firing Point Data Form. Multiply the night fraction times the number of rounds fired, round to a whole number, and enter in columns 25 through 28 as shown in Figure 41.

Example:

2/3 (day fraction) x 85 rounds = 56.66 = 57 rounds per day

1/3 (night fraction) x 85 rounds = 28.33 = 28 rounds per night

To check the arithmetic, 57 rounds per day + 28 rounds per night = 85 total rounds.

However, if it is known that fire occurred primarily during the day or night (rather than uniformly over the total time period), the total number of rounds should be split according to the actual pattern of firing.

Columns 33 Through 35, Target Identification

If the weapon code was 10 or 11 from Table 3 (TNT), the Target Identification is a blank since the actual firing took place at the firing point and there is no associated target. Five cases will illustrate how to complete the Target Identification columns: the first section describes what to do when targets are not grouped; the final four outline procedures when targets are grouped.

Targets Not Grouped

When an installation uses a small number of targets (less than 25), the target for each firing point is usually known. Enter the Target Identification Code in columns 33 through 35. If the target for each firing point still cannot be found, use the method described in *Targets Grouped (Simple Case)*, below. See Figure 42 for an example of a completed Firing Point Data Form.

Targets Grouped (Simple Case)

When targets have been grouped into circles, the following method will be observed. To complete these columns the Range Safety Records and map must be used. The person gathering data reads from the records the "Direction Limits" (both left and right), the "Low Angle Point Detonating Minimum Range," and the "Maximum Range to Impact." A Range Safety Card is shown in Figure 43 with these items marked. The information obtained from the Range Safety Card is plotted on the map with the assistance of a protractor calibrated in mils and a scale calibrated to the map scale.

Figure 44 shows firing point 115 over which a protractor has been placed. It can be seen from Figure 43 that the left and right direction limits are at 4920 and 5100 mils, respectively, creating a "pie slice" which cuts through target group 8. The minimum and maximum ranges further establish that target group 8 is the target for firing point 115.

Enter the identification code of the target group in columns 31 through 34 as shown in Figure 45. If the truncated "pie slice" overlaps two target areas (i.e., one-half of the "slice" in one area and one-half in the other) more work is required: see *Targets Grouped (Complex Case)*, below.

Targets Grouped (Safety Fan and Charge Range Given)

Some installations have permanent safety fans drawn on the installation reservation map. When this is the case, a Range Safety Card is not prepared for each firing since the safety fan has been made large enough to include all possible combinations of weapons, charges, projectiles, and trajectory. The most probable impact point lies on the centerline of the fan. The range control office should be consulted as to the manner of firing on a typical day to get additional information on the choice of probable target. The Battery commanders are also an excellent source of information for determining the typical impact point. It may be that the primary impact area does not lie on the centerline of the safety fan because of a favorite target (auto body) to the left or right. Or the charge range used may be misleading: the rounds may be fired on a flat trajectory to keep them under radar range or they may be fired in a high trajectory for a "fire-for-effect" exercise. Once again, ask many questions until the whole pattern of firing becomes clear. It is not unusual to have two or three probable impact areas, one for each unit's unique firing pattern.

Figure 46 shows a typical safety fan with its centerline plotted. The probable target is at a point along the centerline of the safety fan midway between the distance which corresponds to the minimum and maximum charge ranges. The minimum and maximum charge range limits are determined by using the trajectory charts from the Firing Gun Table for the weapon being used at the firing point under consideration (see samples,

Figures 47, 48, 49). (The typical charge range used should be obtained from the range control office or the Battery commander.) If the angle of fire is unknown, choose 600 mils as a typical angle. For example, for a 155-mm howitzer, using charges four to six at 600 mils, the minimum and maximum ranges are 7600 and 11 300 m, respectively (see Figures 47 and 49). These limits are plotted and the target location is chosen midway between 7600 and 11 300 m, i.e., 9450 m from the firing point as shown by the X in Figure 50.

Figure 51 illustrates another example. Although the chosen target point lies on the centerline of the safety fan 9450 m from the firing point, Battery A likes to shoot with a flat trajectory at the mountainside to the left of the centerline. Similarly, Battery B is practicing high-angle fire on the car body to the right. For this case, two target points are chosen. When the range control log indicates that Battery A is firing at firing point 110, the target point to the left (Y) is chosen; when Battery B is firing, target point Z is chosen.

Targets Grouped (No Charge Range Given)

If range control personnel or actual gun batteries cannot decide on the "typical" charge range or favorite target group, use the following procedure. The probable target group lies on the centerline of the safety fan as before. The distance from the firing point to the target impact point is three-fourths of the distance to the maximum limit of the safety fan (see Figure 52). It can be seen that the target lies on the centerline of the safety fan approximately three-fourths of the distance from the firing point to the maximum safety limits.

To determine the charge range to be entered in columns 29 through 32 of the Firing Point Data Form, consult the trajectory chart from the Firing Gun Table for the weapon type used at the firing point under consideration. First, locate the 800 mil trajectory curve for each charge weight and its intersection with the 0 altitude axis. Determine the smallest charge weight whose intersection at 0 altitude exceeds the distance to the probable target. This is the maximum charge range. Next, locate the 600 mil trajectory curve for each charge weight and its intersection with the 0 altitude axis. Determine the largest charge weight whose intersection at 0 altitude comes closest to, but does not exceed, the distance to the probable target. This is the minimum charge range.

For example, Figure 52 indicates a target point three-fourths of the distance from the maximum safety limit of the safety fan -- 11 400 m. Using the method just described above, the target point is located at a distance three-fourths of 11 400 m, or 8550 m from the firing point. To find the charge range for a 155-mm howitzer fired at firing point 110, consult Figures 47, 48, and 49. Table 6 is a summary of the distances to the intersections of the trajectory curves for the 600 and 800 mils azimuths for 155-mm howitzer charge weights of 3, 4,

and 5. It can be seen that charge 5 is the smallest charge that exceeds 8550 m for the 800 mil azimuth (9700 m > 8550 m). Charge 4 is the largest charge which comes closest to, but does not exceed 8550 m (7600 < 8550 m). Figure 53 gives an example of the Firing Point Data Form with the charge ranges indicated in columns 30 and 32. The probable target has been entered in columns 33 through 35.

Table 6

Maximum and Minimum Charge Range Example*

Azimuth of Target (mil)	Charge Weight 4W	5W	6W
600 mil	7600	9200	11 300
800 mil	8050	9700	12 000

*Distance to target point from Figure 52 = 8550 m

Targets Grouped (Complex Case)

This case is used when two or more target groups are included within a truncated "pie slice," and the specific percentage breakdown of rounds by target grouping is not known. But if the percentage is known, use it rather than this complex procedure. Figure 54 shows the Range Safety Card for firing point 7 with direction limits and ranges marked. Figure 55 is a map of the firing area of firing point 7 with a protractor overlay. Referring to Figure 56, all necessary information has been marked on the map. As can be readily seen from the shading, target group 8 lies within one half of the truncated "pie slice," and target group 9 lies in the other half. The Range Control Log in Figure 57 has been provided for reference.

When target groups are divided in this way, new lines must be created on the Firing Point Data Form. The Firing Point Data Form for firing point 7 is shown partially completed in Figure 58. Items filled in include Firing Point Identification, X and Y coordinates, weapon type, charge range, and number of rounds per day and night.

In review: to fill in the number of rounds per day and number of rounds per night, look at the Range Control Log shown in Figure 57. Under "Actual Time (In/Out)," it is seen that firing occurred between

0500 and 1300 hours. Since day starts at 0700, this is 2 hours in the night and 6 hours in the day or one-fourth in the night and three-fourths in the day. The "Rounds Fired" (40) from the Range Control Log have been divided, 10 for the night and 30 for the day as shown in the Firing Point Data Form in Figure 58.

The rounds are also divided between target groups 8 and 9 (Figure 56). The first step in filling out the Firing Point Data Form is to copy the weapon type and charge range to the line below, as in Figure 59.

Next, identify each line by putting the target identification code in columns 33 through 35. The first line is for target 8 and the second for target 9. Erase the 30 rounds per day in columns 21 through 24 of Figure 58 and replace it with a 15 for both targets 8 and 9. This is done because one-half the rounds in the day went to target 8 and one-half to 9. The number of rounds per night is done in the same fashion and is shown in Figure 60. Note how the Firing Point Data Form of Figure 60 differs from the initially incorrect one in Figure 58.

Column 36, Projectile Flag

Enter a 1 in column 36 if firing blanks, inert rounds, WP, ILLUM, or smoke, or if using weapon code 10 or 11 in columns 19 and 20 (i.e., if there was no blast-like event at the target location). Otherwise leave column 36 blank.

Columns 37 Through 41, Height Above (+) or Depth Below (-) Ground

Enter the height of the airburst in feet in columns 31 through 41. If C4 (or other explosives, weapon codes 10 or 11) was detonated above ground, enter the height in feet in columns 37 through 41. If C4 or satchel charges were buried, enter the depth in feet preceded by a minus sign (see Figure 61). Otherwise, if using point detonating fuses or detonating C4 on the ground, leave columns 37 through 41 blank.

Column 1, End of Source Data Flag

After all items have been entered into the Firing Point Data Form, place an asterisk in column 1 of the last line of data as shown in Figure 62. This signifies the end of the Firing Point Data Form.

Recommended Data Gathering Technique

It is obvious that the data for the Firing Point Data Forms may be difficult to develop unless the appropriate records are kept. Figure 63 illustrates a site form which is recommended for gathering operational blast data. The units fill out this form in the field. Since the site forms provide all the information included on the Firing Point Data Forms, they can be submitted directly as filled out by the units instead of being copied onto the associated Firing Point Data Forms. The target forms are still required but are easy to compile from the data on the site forms. The Appendix gives brief instructions on filling out the site forms.

4 GUIDELINES FOR SUBMISSION OF DATA

General

This chapter explains how to submit information to CERL when requesting L_{Cdn} equal annoyance contours. Subjects discussed include the ordering of contours, specific options available, materials the installation will receive, the cost of this service, and the person to contact if difficulties arise.

Each set of L_{Cdn} contours is a generalized overlay plotted to the scale of the installation maps. These contours depict "equal annoyance levels" and are in a form which can be thought of as a "footprint" of the noise impact. They are actually a composite based upon the average or typical total daily operations of the military facility.

Ordering of Contours; Materials to Be Submitted

The installation ordering L_{Cdn} equal annoyance contours must complete and furnish two types of data sheets and the attachment form as described in this chapter. In addition, the military installation must also send CERL two maps. These materials include the following:

1. Target Data Sheets containing the information concerning the location of targets on the military installation (Figure 5).

2. Firing Point Data Forms containing the information about firing point locations and their associated targets, weapon types, number of rounds, and types of ammunition (Figure 24).

3. An Attachment Sheet (Figure 64) specifying information covered in both the forms described in the two preceding paragraphs. This information includes:

   a. Study preparation. This section of the Attachment Sheet must be completed in its entirety including name of the installation, person preparing forms, etc. Be sure to include both the name of the person preparing the forms and his/her commercial telephone number.

   b. Type of contour. Whether or not this form is for an original or an additional contour.

   c. Inversion condition. This percentage for the installation will be specified if operations are controlled or if this is for an optional hypothetical condition (i.e., no firing during temperature inversion conditions). However, for most installations, CERL personnel will compute the inversion percentages at the needed altitudes from data supplied by the National Weather Service for measurement locations in the vicinity of the base.

d. Day/night operating conditions. This optional condition specifies that only the daytime (or nighttime) data will be used to generate the contour. As always, the data used represents an average over the full period from which the raw data is taken. Details are presented below in Specific Options.

e. Time period data was taken. Normally, a minimum of four months of data, 1 month from each quarter of the year, will be required to complete the Target Data Sheet and Firing Point Data Forms. If there is a large variation in operations, up to 12 months of data on firing activity may have to be considered at the time that the data forms are being completed. (A large variation is a 40 percent or more change in operations between different months of any quarter.) If there is a large variation between quarters, CERL should be consulted before work is initiated.

f. Locations specified. This is the method used at the installation for describing the locations of firing and target points. Locations are specified in feet or meters only.

g. Additional weapon types with assigned codes. These are used for any weapons not listed in Table 3. The corresponding code is for use in the Firing Point Data Form.

h. The installation reservation map. This map, described in AR-210-20, must be supplied when ordering contours. The contour map overlay produced by computer will fit the scale of this map.

i. Map of the area. A map showing areas within a 16- to 24-km radius of the installation must be supplied (a scale of 1:50,000 is suggested). Contours may or may not be produced for this map depending upon the noise impact upon the installation. Maps will be retained at CERL in the event of future questions.

Specific Options

Two options are currently available. One is the Inversion Condition and the other is the Operation Condition. Inversion conditions significantly affect the propagation of sound through the atmosphere. Specification of either or both of these options will result in an additional set of contours generated at extra cost to the military facility.

Inversion Condition

The inversion condition is the percentage of time that a temperature inversion is present during a 24-hour day. Since a temperature inversion is most likely to occur in the period between 2 hours after sunset and 2 hours after sunrise, firing performed during noninversion hours reflects a reduced noise impact.

If an installation operates on a reduced schedule of hours, this will impact the percentage of inversions. Thus, the installation must inform CERL of the actual hours of firing. This information should be written on the attachment sheet (Figure 64) in the area concerned with percent of inversions.

As an option, an installation may request an additional contour depicting the effect of eliminating firing during some or all the hours during which inversions occur. A request for an additional contour requires an additional attachment sheet (Figure 64) and the requestor should write "Supplemental Contour" at the top of the sheet.

Day and Night Firing

Day and night firing (0700 to 2200 and 2200 to 0700, respectively) is important for the noise impact. A penalty is assessed for night firing. If an installation already fires only during the day, this is evident in its submitted data. As an option, an installation may request an additional contour depicting the effect of transferring night firing to daytime hours. A request for an additional contour requires an additional attachment sheet (Figure 64), and the requestor should write "Supplemental Contour" at the top of the sheet. Similarly, if desired, a contour can be generated for night only.

Materials the Installation Will Receive

Following receipt of completed data from the installation, evaluation and contour generation can be expected in 5 weeks. The base will receive a set of L_{Cdn} equal annoyance contours plotted to the scale of the installation reservation map. If there is a significant noise impact, another set of contours will be plotted to the scale of the larger area map that was supplied by the facility. Any additional contours showing desired inversion and operating conditions that were requested by the military installation will be included.

Cost

The cost of this service will vary depending on the complexity of operations at the installation, but a median value of $1500 (FY80) can be anticipated for an installation with fairly extensive blast operations.

Difficulties Encountered

Communication, both by telephone and letter, is invited and encouraged during the time the installation is completing data sheets. If it is found that there is a noise impact upon the military installation,

assistance may be requested in the preparation of land use and population density maps. Written correspondence may be addressed to CERL-EN, P.O. Box 4005, Champaign, IL 61820, or to the Office of the Chief of Engineers, Washington, D.C. 20314.

5 ABBREVIATED DIRECTIONS

General

This chapter presents abbreviated directions to be followed in entering the operational data on the Target Data Sheet and the Firing Point Data Forms. Once again, users are requested to read the entire manual before attempting to gather any operational data.

Completing Target Data Sheet

Column 1, End of Target Data Flag

Place an asterisk (*) in Column 1 of the last entry on the last Target Data Sheet. This indicates the end of your target data.

Columns 2 Through 6, Target Identification

Less Than 25 Targets. Copy the target identification code from the map (Figure 8) and enter in the data sheet (Figure 9).

More Than 25 Targets. Group targets into the largest circle possible, namely circles of radius 1/2, 1, or 1 1/2 km. If surveyed targets do not appear on the map, completely cover the impact area with circles of appropriate radii. The radius of a circle must not exceed one-fifth of the distance between a population area and the center of the circle (Figures 12 and 13). Draw smaller circles if necessary. Create a unique numerical code for each circle, write it on the map, and enter it on the data sheet (Figure 14).

Columns 7 Through 12, X Coordinate; and Columns 13 Through 18, Y Coordinate

Targets Not Grouped. The base reservation map is easiest to use to read coordinates of target points (Figures 16, 17, and 18). Enter five-digit numbers for both the X and Y coordinates in the data sheet (Figure 19). Accuracy is needed to only the 100 m place. If using the installation's Table of Metric Grid Coordinates for target areas, the first five digits under "grid reference" are the X coordinate and the last five are the Y (Table 1). Enter the X and Y coordinates directly into the data sheet (Figure 20). If there is ever any repetition or confusion, six digits should be used. (See Chapter 2.)

Targets Grouped. Use the center of each circle as the location of the target area (Figure 21). Enter 5-digit coordinates from the map for each circle group in the data sheet (Figure 22).

Completing the Firing Point Data Forms

Column 1, End of Source Data Flag

Place an asterisk (*) in column 1 of the last entry for each source. This signifies the end of the firing point data for that source.

The Box Above Columns 2 Through 5, Firing Point Identification

Read the firing point identifier from appropriate range records such as the Range Safety Card, the Range Control Log, the Range Request Form, or the site form (Figure 63), and copy directly into the box above columns 2 through 5. If a firing point has a direction letter following the identification number, place this letter above column 6. Create a new label for any demolition sites (D1, D2, EOD3, etc.) Only one firing point identification number is used on a Firing Point Data Form but the sheet can be used for the full duration of gathering data. For additional sheets, cross out the boxes at the top of each continuation sheet.

The Box Above Columns 7 Through 12, X Coordinate; and Columns 13 Through 18, Y Coordinate

Obtain information from the daily range records, the installation's Table of Metric Grid Coordinates for firing points and mortar positions, or the base reservation map (Figures 16, 17, and 18.) These coordinates can usually be rounded to the nearest 100 m, but if noise-sensitive land uses lie within 500 m greater accuracy is needed (i.e., round to 10 m).

When obtaining data from the base Table of Metric Grid Coordinates for firing points and/or positions, truncate and enter the last five digits. If there is ever any repetition or confusion, six digits should be entered. (See Chapter 3.)

Columns 19 Through 20, Weapon Type

Consult range records and double-check, if possible, since a firing point can have more than one type of weapon per day. Read weapon code from Table 3 and enter code in the Firing Point Data Form. If weapon is not listed in Table 3, assign the next unused code number to the weapon and include this information in the Attachment Sheet (Figure 64).

Columns 29 Through 30, Minimum Charge; and Columns 31 Through 32, Maximum Charge

1. If the weapon code in columns 19 and 20 was other than 10 or 11, follow instructions in a, b, or c, below.

2. If weapon code was 10, follow instructions in d, below.

3. If weapon code was 11, follow instructions in e, below.

a. Weapon Charge Range. The weapon charge range is given in range records. Enter the number after "minimum charge" in columns 29 and 30, and after "maximum charge" in columns 31 and 32 (see Figure 32).

b. Weapon Code, Charge Known. If a typical charge is known, enter the charge number in both columns 29 and 30, and 31 and 32.

c. Weapons, Charge Unknown. Use Range Safety Forms, tables of Ballistics for the Round used, or discussions with range personnel to determine the typical change range or target combination used.

d. Small Charge C4 or Other Explosive (Code 10). Enter a one- or two-digit code from Table 4 in both columns 29 and 30, and 31 and 32. Note: The number of blasts is more important than the size of the blast. Therefore, be careful whether 50-lb of C4 actually represents one 50-lb blast or fifty 1-lb blasts.

e. Large Charge C4 or Other Explosive (Code 11). Enter the one- or two-digit code from Table 5 in both columns 29 and 30, and columns 31 and 32.

Columns 21 Through 34, Number of Rounds per Day; and Columns 25 Through 28, Number of Rounds per Night

Fire Occurring Entirely During Day. If fire occurs between 0700 and 2200 hours, obtain the number of rounds fired from available Range Records (Figure 36) and enter in columns 21 through 24 of the Firing Point Data Form (Figure 37). Skip over columns 21 through 24.

Fire Occurring Entirely During Night. If fire occurs between 0000 and 0700 hours or 2200 and 2400 hours, obtain the number of rounds fired from the range records (Figure 38) and enter in columns 25 through 28 of the Firing Point Data Form (Figure 39). Skip over columns 21 through 24.

Fire Overlapping Between Day and Night. Split the total rounds fired proportionately between the rounds fired during the day in columns 21 through 24 and rounds fired during the night in columns 25 through 28 (see Figures 40 and 41).

Columns 33 Through 35, Target Identification

Targets Not Grouped. On an installation with a small number of targets, the target for each firing point is usually known or can be obtained easily. Enter the target code in columns 33 through 35 (Figure 42).

Targets Grouped (Simple Case). From the Range Safety Records, read the "Direction Limits," "Low Angle Point Detonating Range," and "Maximum Range to Impact" (Figure 43). Lay a protractor over the map and draw a "pie-shaped" section from the direction limits. Use a ruler calibrated to the map to truncate the "pie slice" for the range (Figure 44). If the truncated "pie slice" covers only one target area, enter the target group identification code in columns 33 through 35 (Figure 45). If the truncated "pie slice" covers more than one target group, consult Targets Grouped (No Charge Range Given), below.

Targets Grouped (Safety Fans Given). Determine the probable impact point for each safety fan by the procedure above. However, discussions should be held with range personnel or Battery commanders to determine the "favorite" targets. If the favorite targets fall in two target areas, consult Targets Grouped (Complex Case), below.

Targets Grouped (No Charge Range Given). If range control personnel or Battery commanders do not give a typical charge range, estimate the probable target impact area as three-fourths of the distance to the maximum limit of the safety fan. Consult the trajectory charts from the Firing Tables for the weapon being used at the firing point under consideration to determine the minimum and maximum charge ranges (see Figures 47, 48, 49, 52, 53, and Table 6).

Targets Grouped (Complex Case). If the truncated "pie slice" covers two or more target areas (Figure 55) divide the number of rounds based on the ratio of included areas. Create a new line in the Firing Point Data Form and transfer the weapon type and charge range to the line below. Identify each row by the correct target identification code entered in columns 33 through 35. Divide the number of rounds per day and night according to the ratio of included areas of target groups and enter these for each target number (Figures 56 and 60).

Demolition Activities. If the weapon code in columns 19 and 20 was 10 or 11, skip over columns 33 through 35 since there is no associated target and the blasting takes place only at the firing point.

Column 36, Projectile Flag

Center a 1 into column 36 if no blast-like (impulse noise producing) event took place at the target area (blanks, inert rounds, WP, ILLUM, and smoke). Also enter a 1 if the weapon code in columns 19 and 20 was 10 or 11 (small or large charges of TNT). Otherwise, leave column 36 blank.

Columns 37 Through 41, Height Above (+) or Depth Below (-) Ground

Enter the height of the airburst in columns 37 through 41 if other than point detonating fuses are used. If TNT (weapon codes 10 or 11) was detonated above ground, enter the height in feet preceded by a plus

sign into columns 37 through 41. If TNT was buried, enter the depth in feet preceded by a minus sign. Otherwise, leave columns 37 through 41 blank.

Attachment Sheet

The following entries are to be included on an additional sheet: whether locations are in feet or meters; assignment of unused code numbers to additional weapon types used at the installation; inversion and operational conditions (see Chapter 4); time period data was taken; name of person preparing work; and information about the installation.

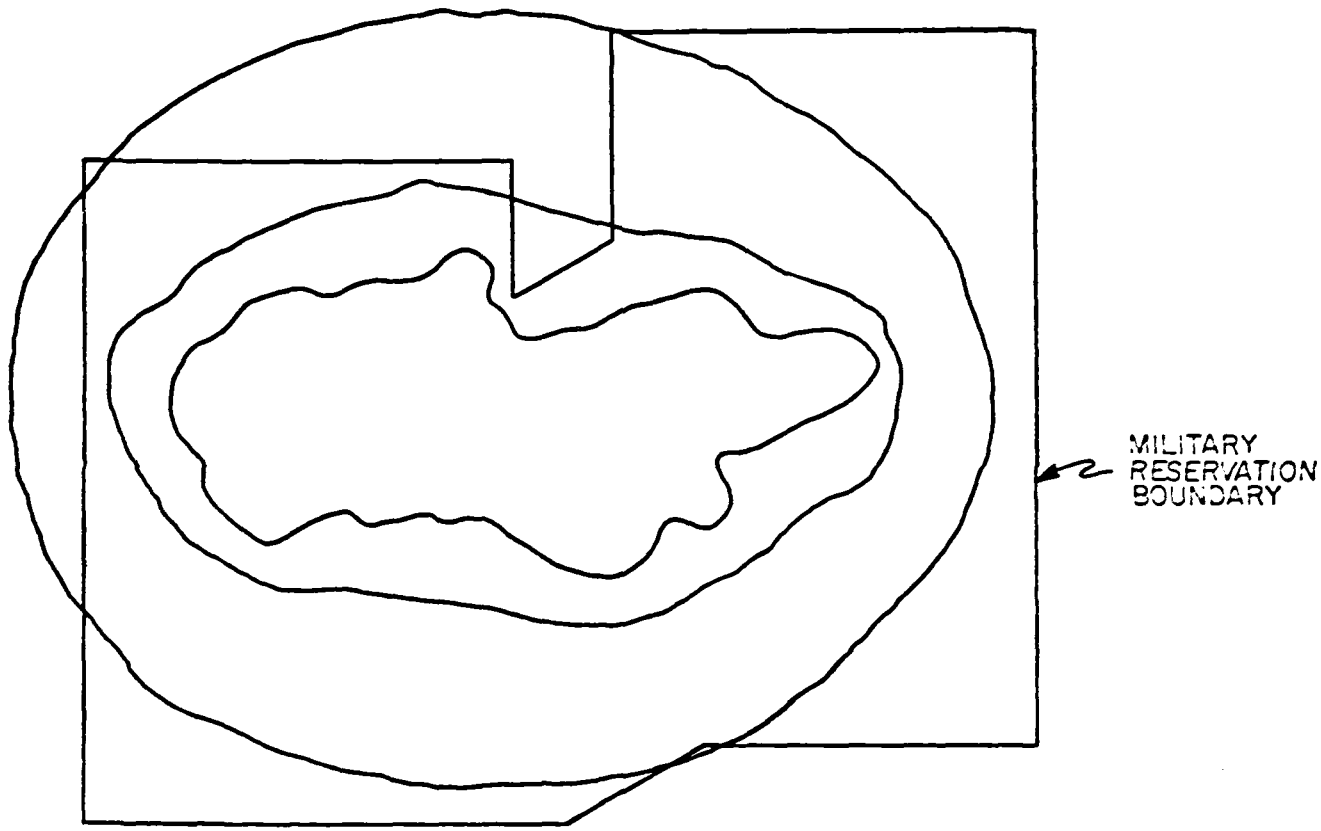

Figure 1. Typical blast noise zone map for a military installation.

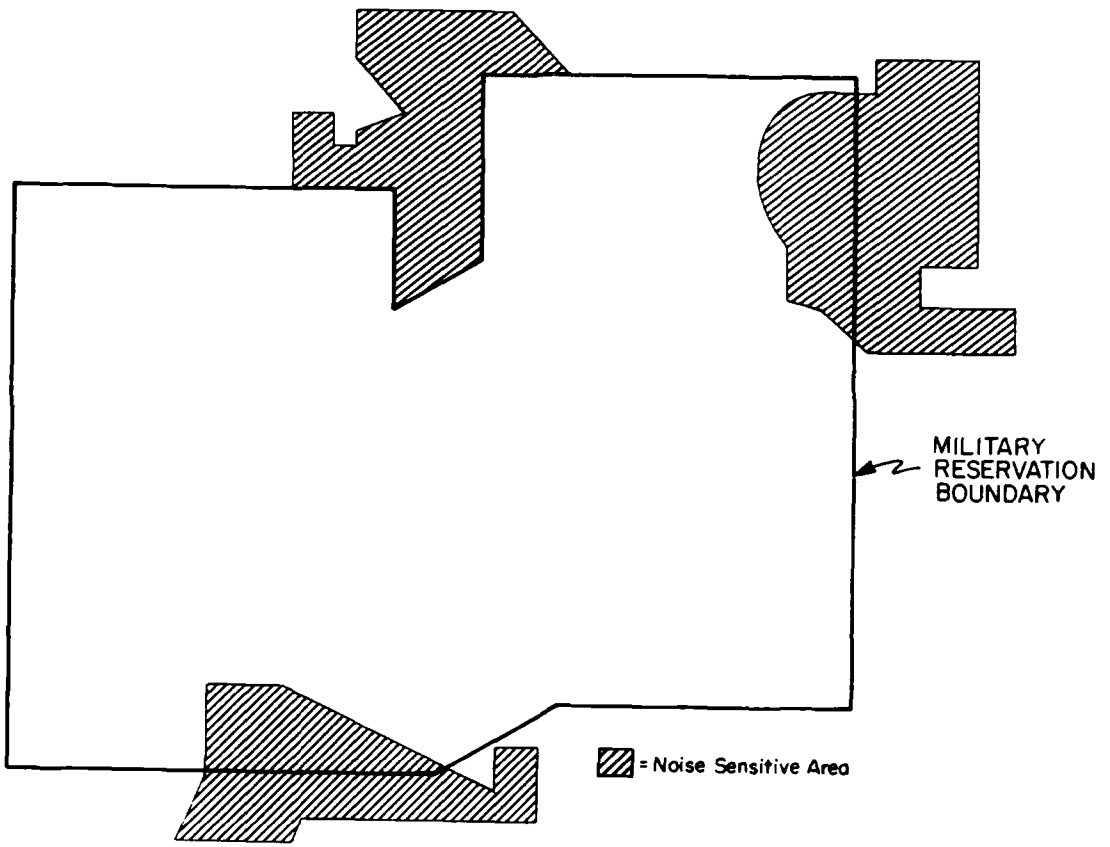

Figure 2. Typical generalized land use map.

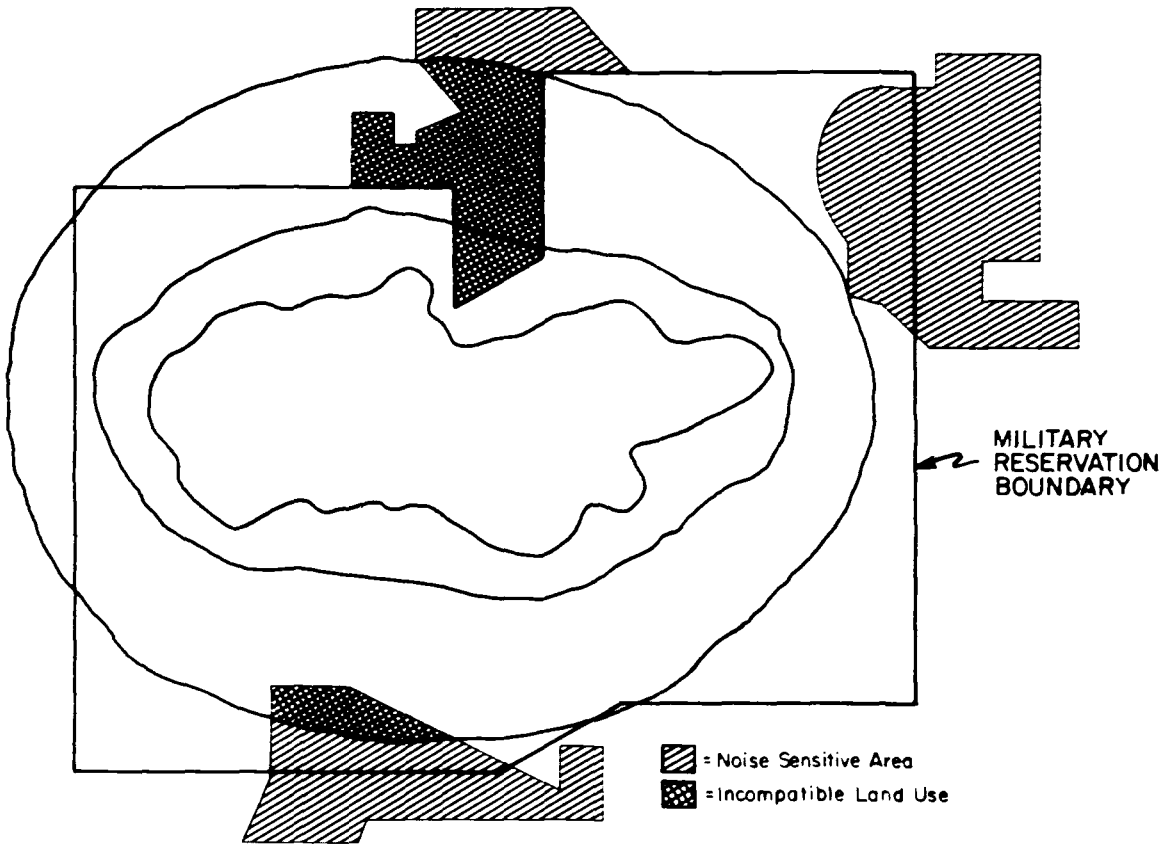

Figure 3. Noise zone map overlayed on generalized land use map.

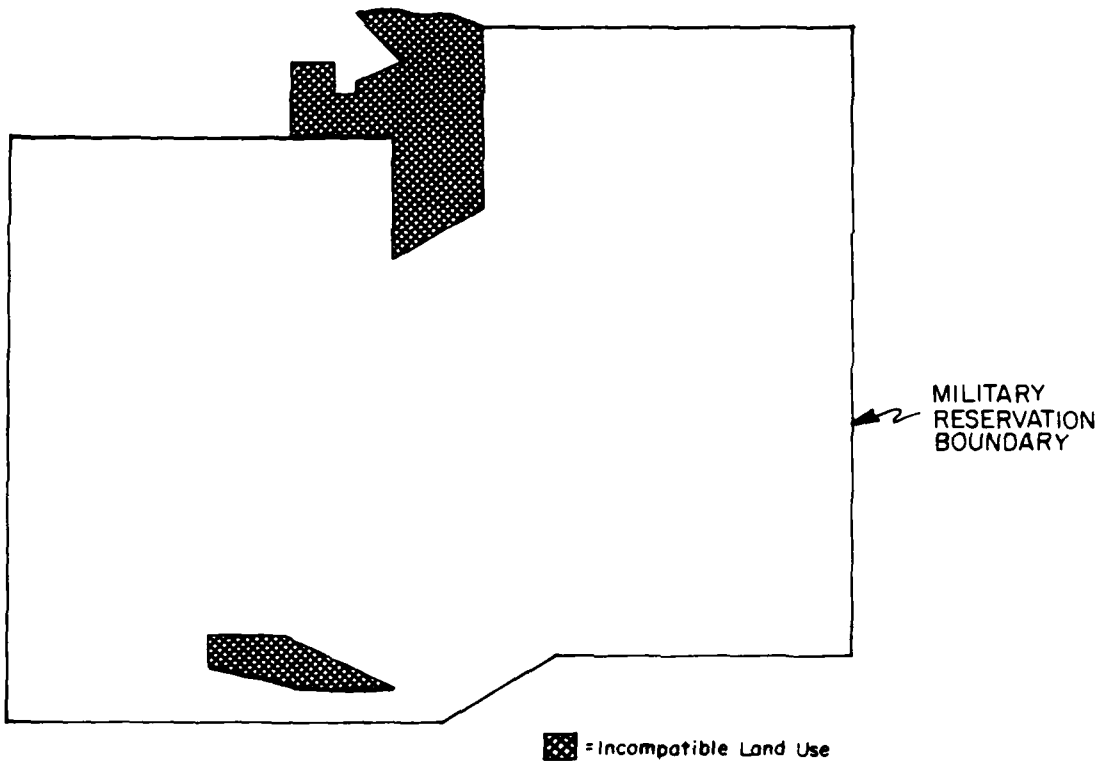

Figure 4. Incompatible areas in the vicinity of the military installation.

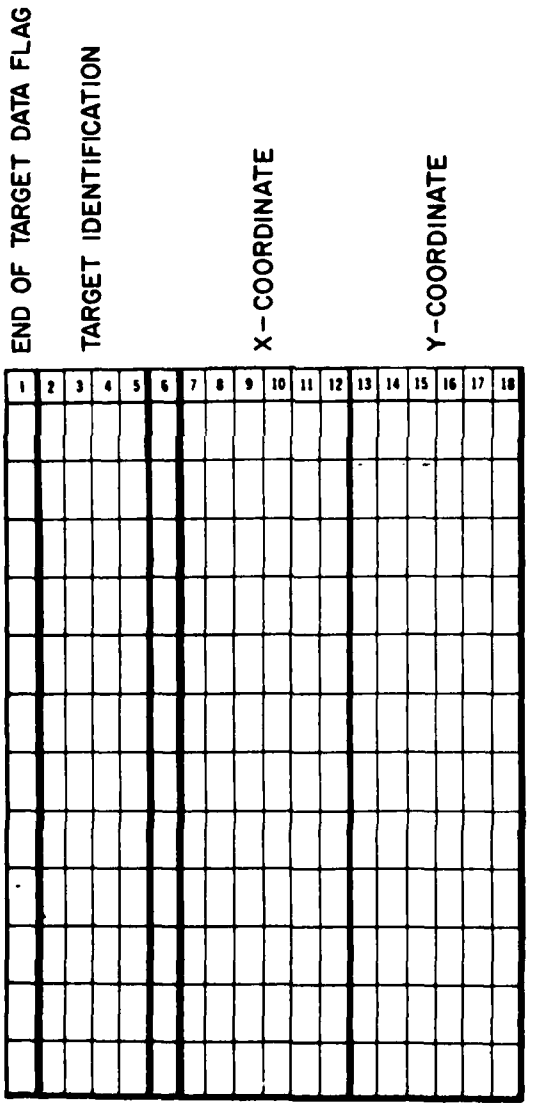

Figure 5. Target data sheet.

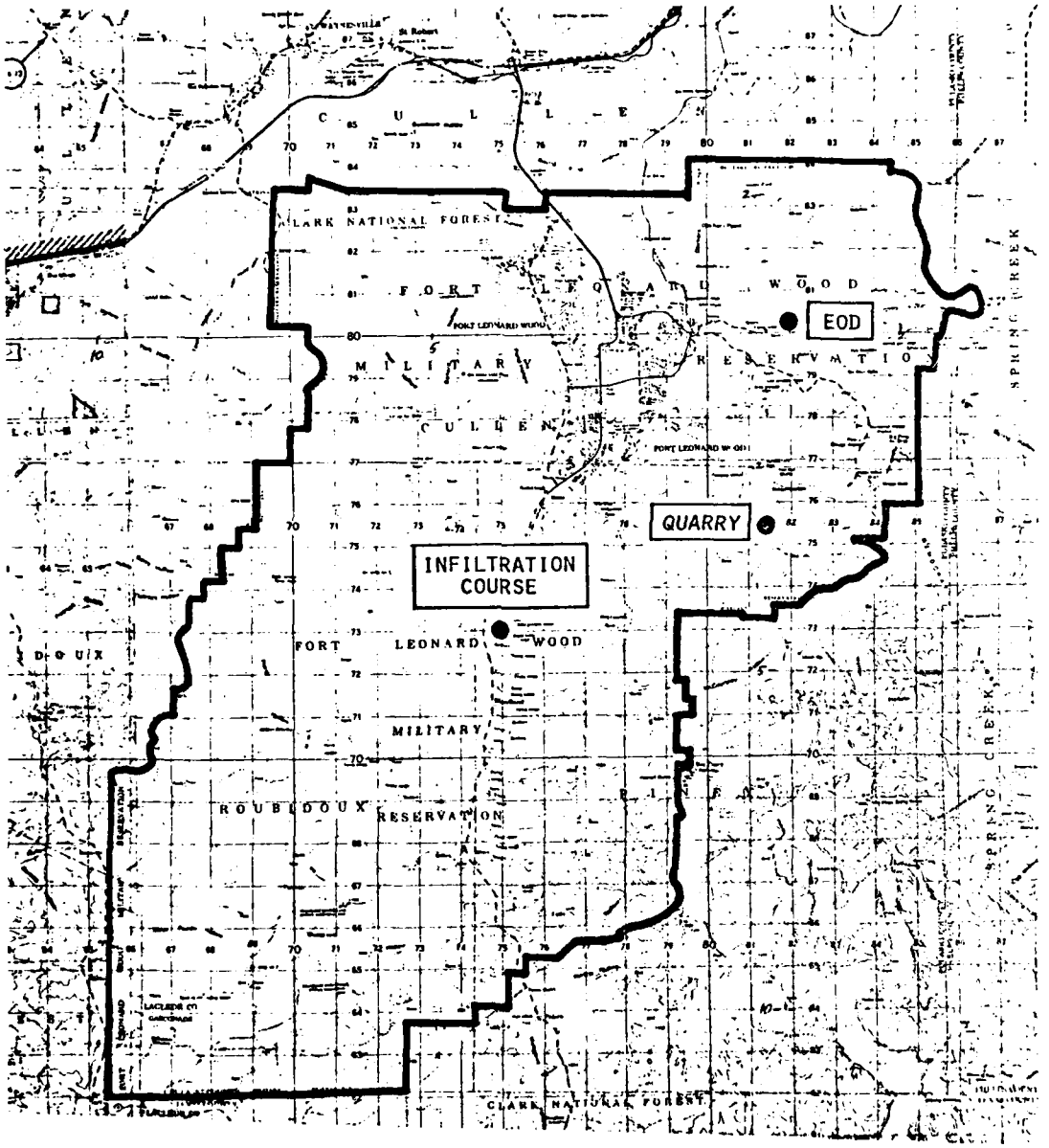

Figure 6. Fort Leonard Wood illustrating an installation with less than 25 targets.

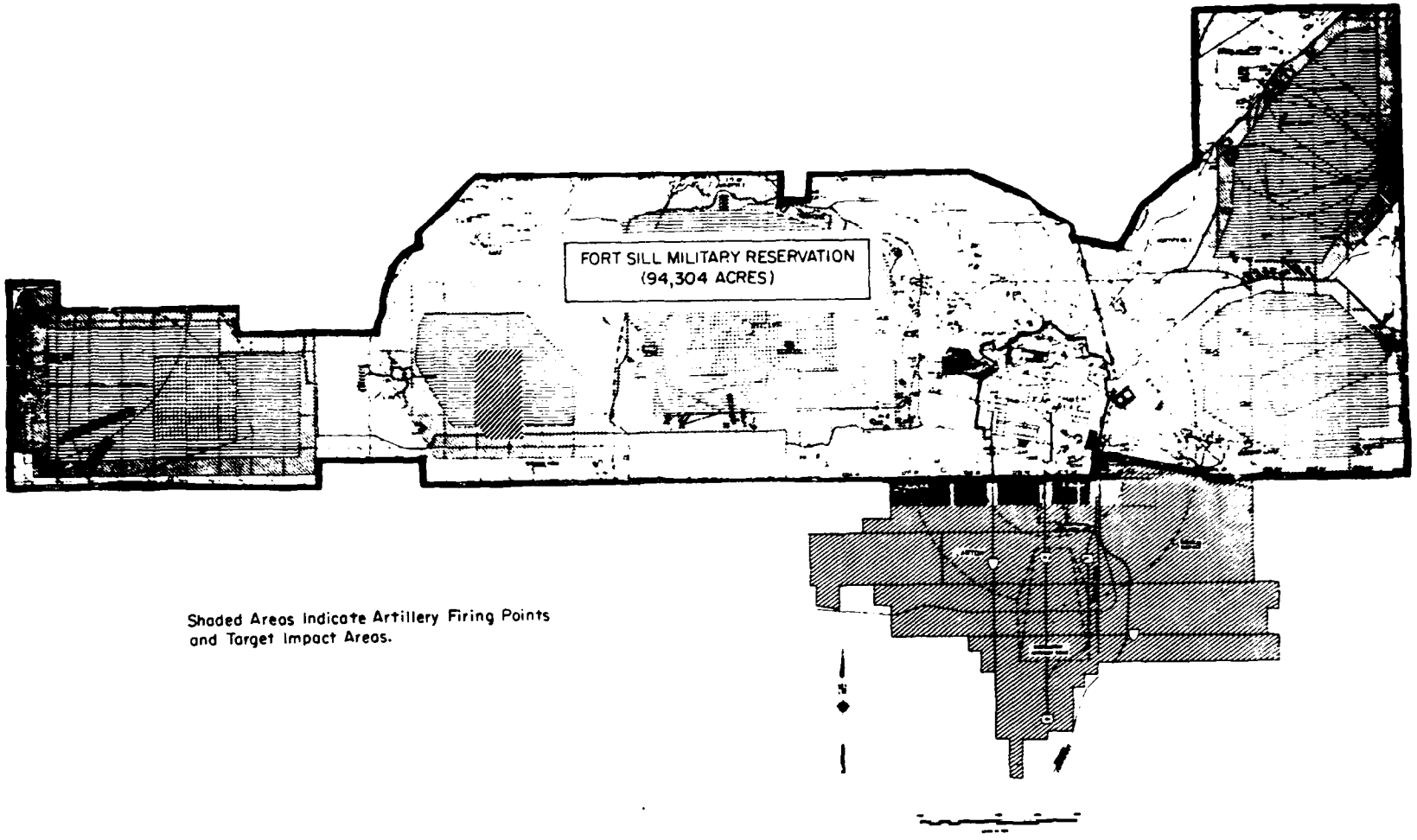

Figure 7. Fort Sill illustrating an installation with more than 25 targets.

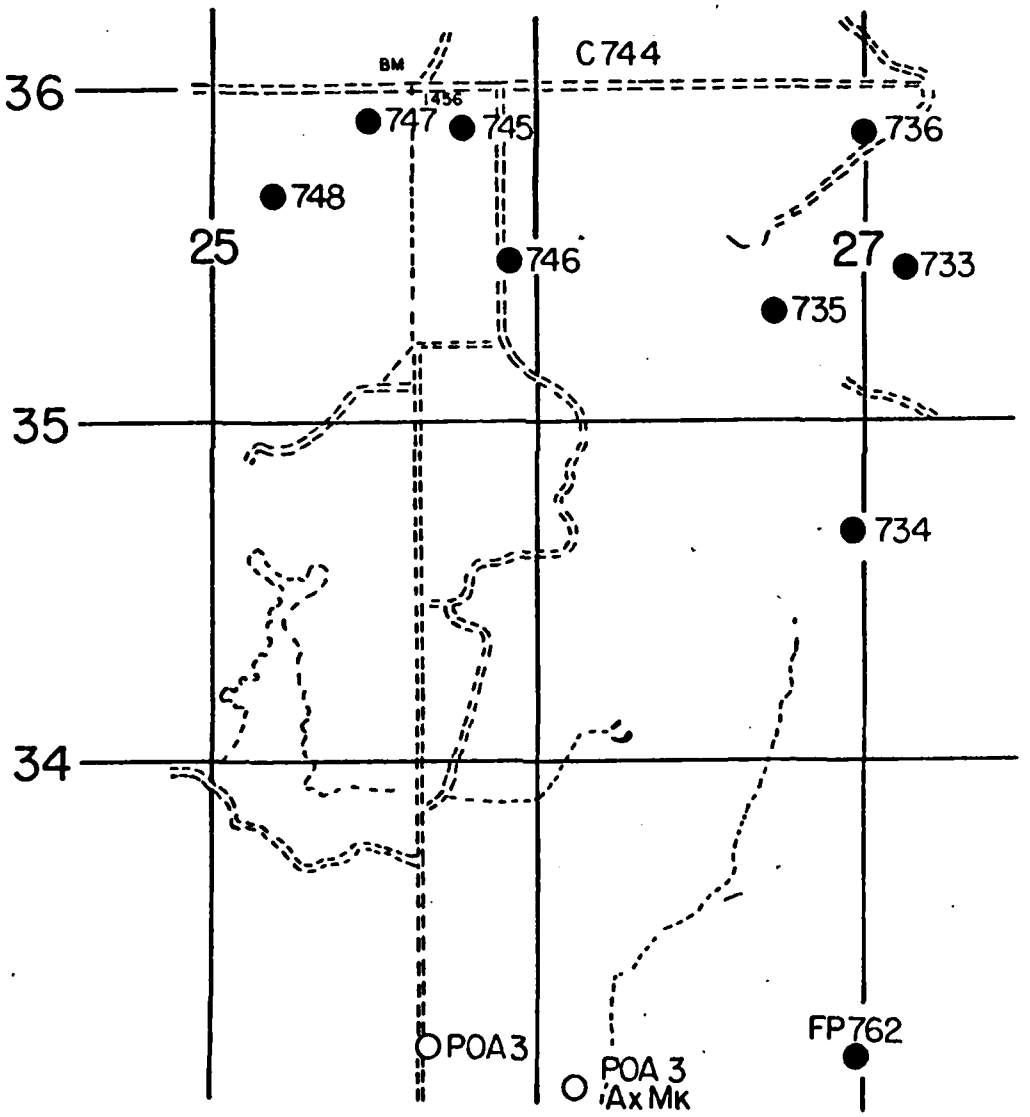

Figure 8. Target identification with eight targets and one firing point.

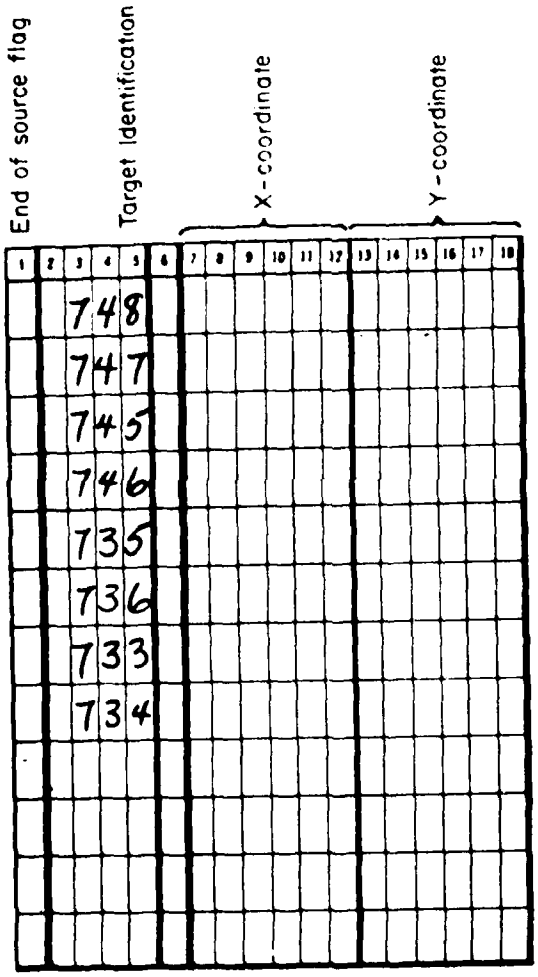

Figure 9. Target data sheet containing identification numbers.

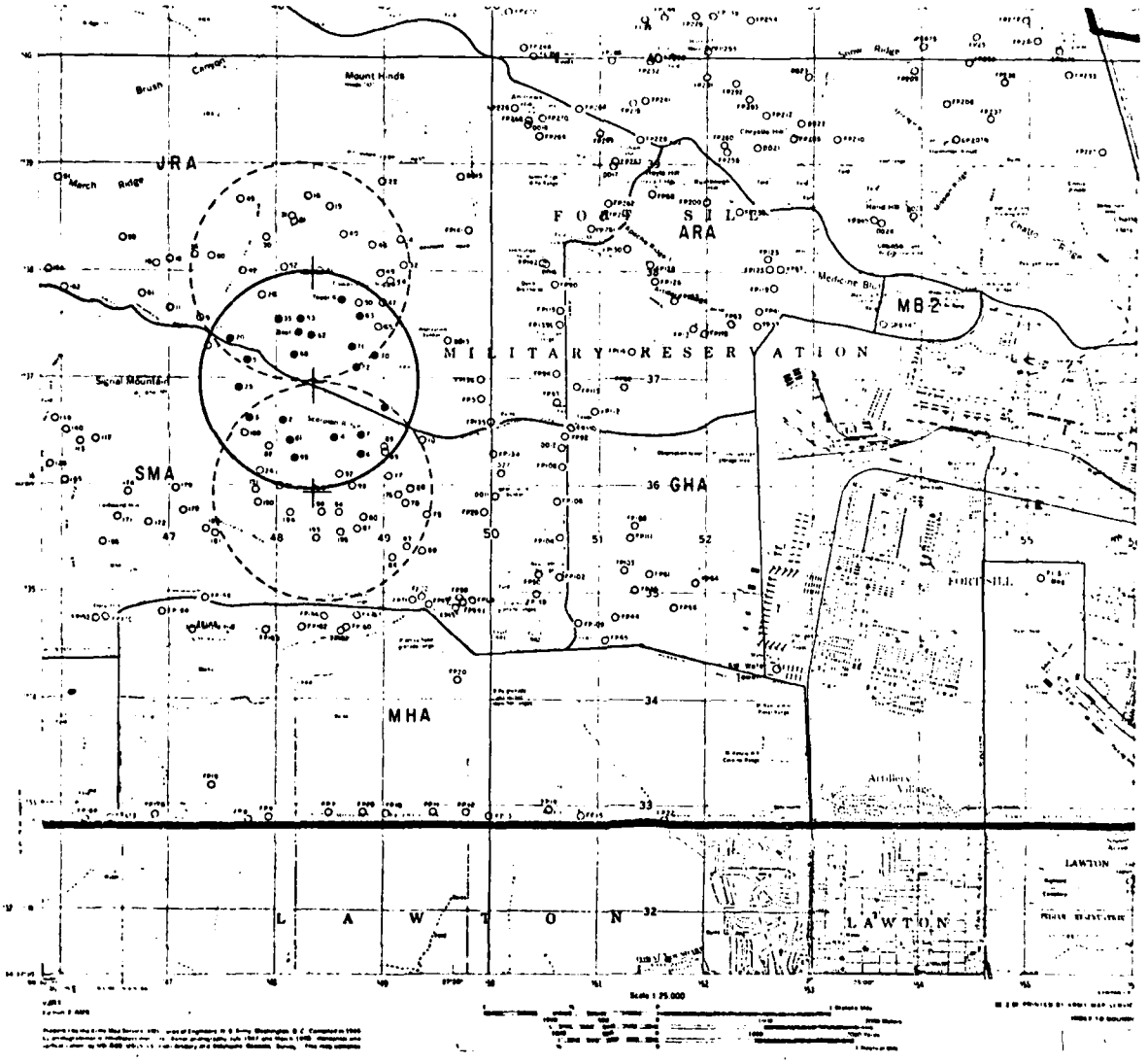

Figure 10. Target groupings.

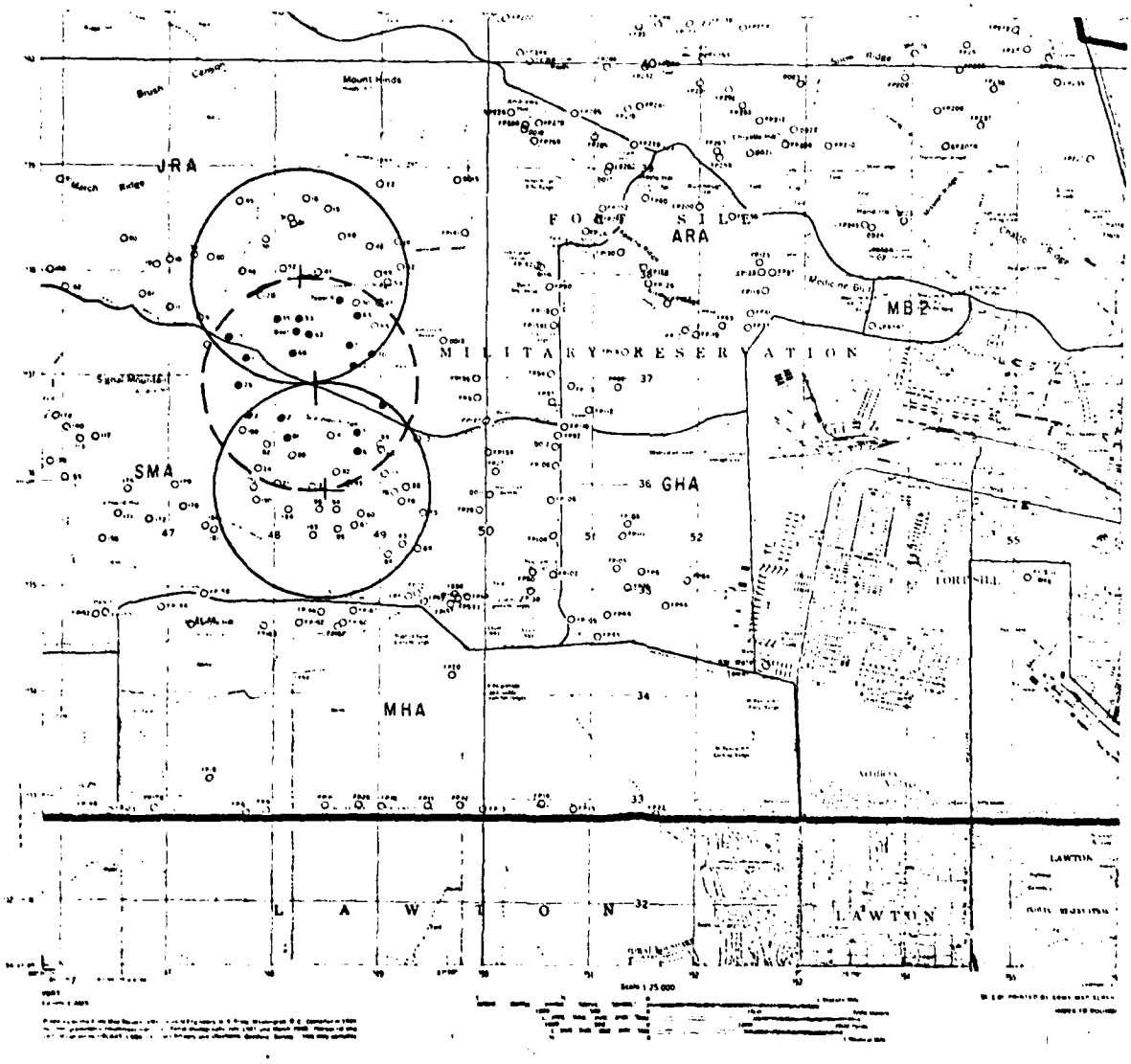

Figure 11. Inappropriate target groupings.

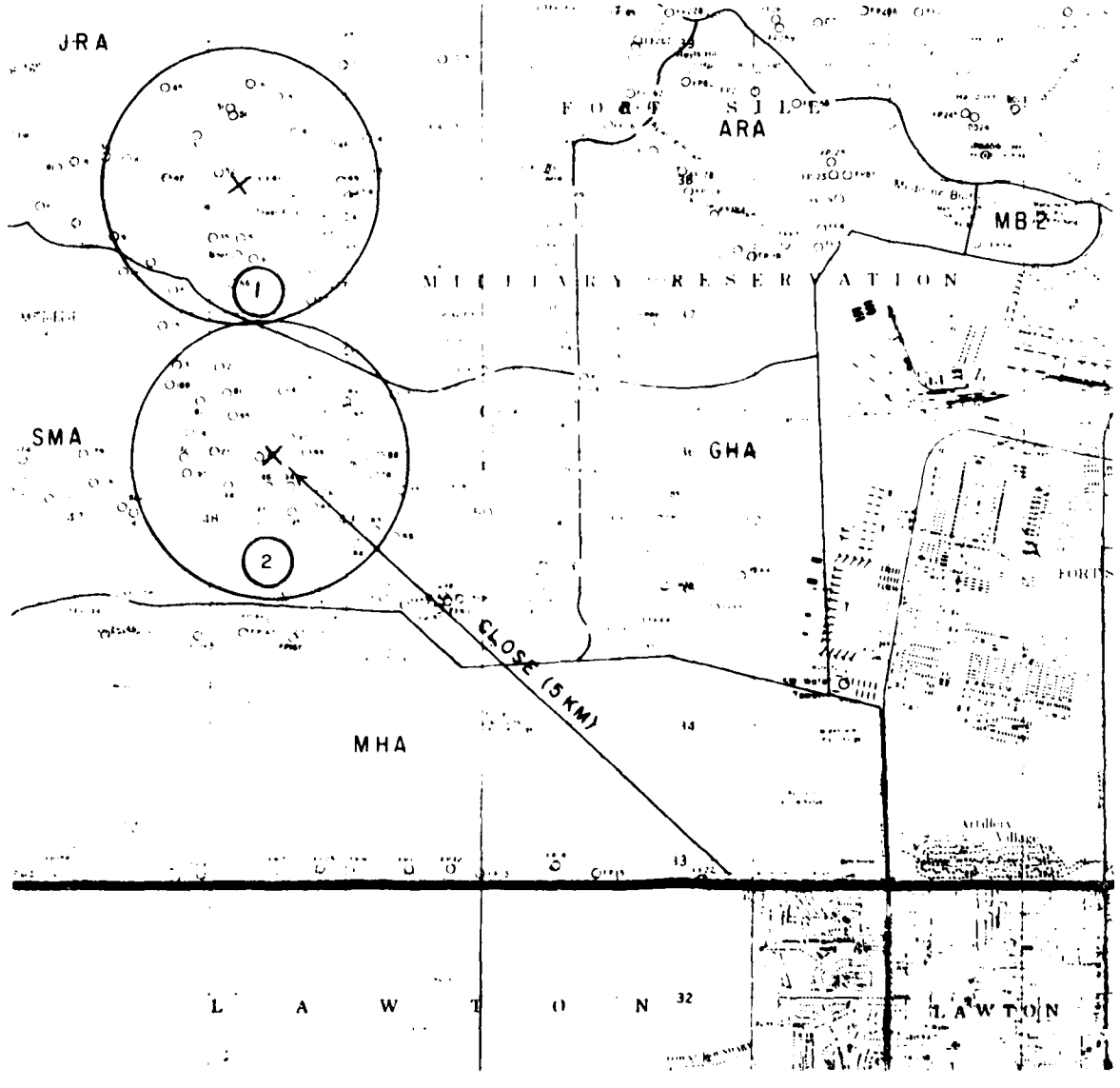

Figure 12. Target grouping close to housing section.

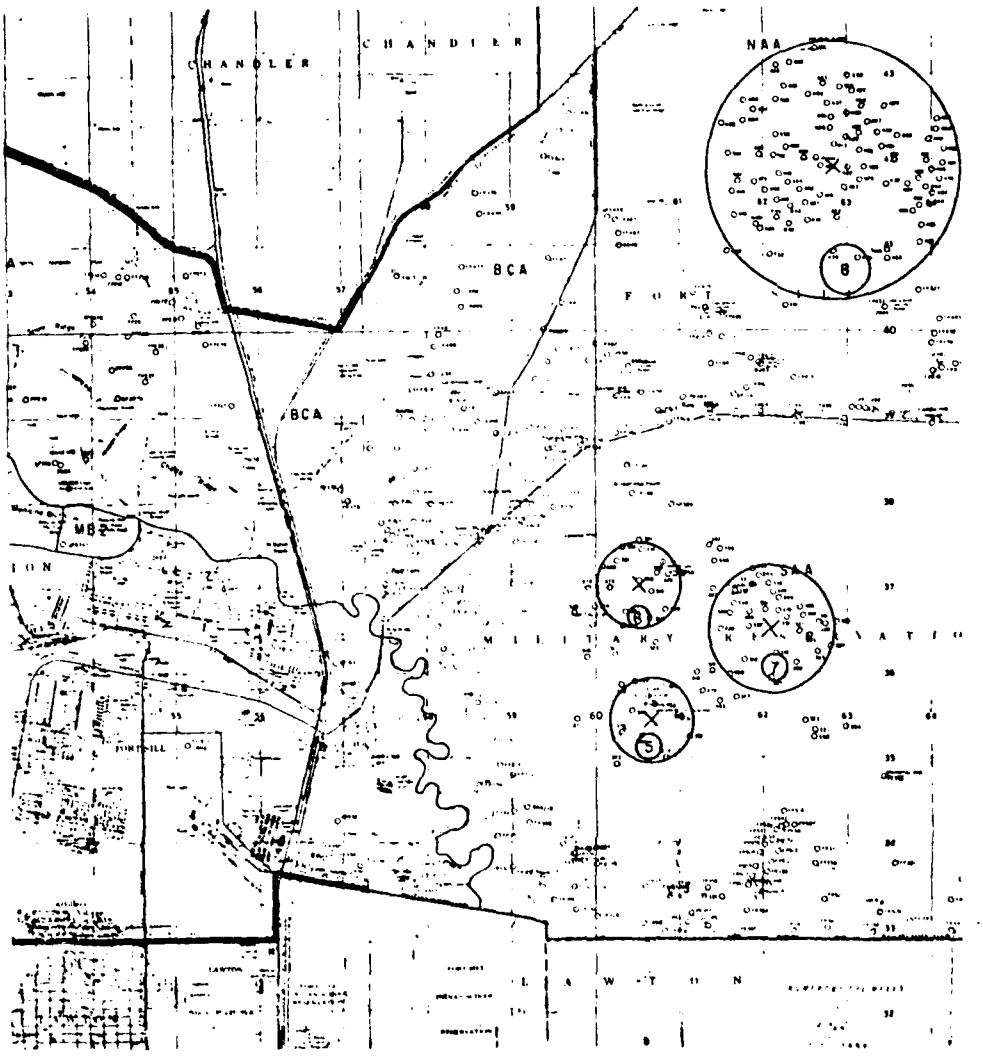

Figure 13. Grouping targets at close and far distances.

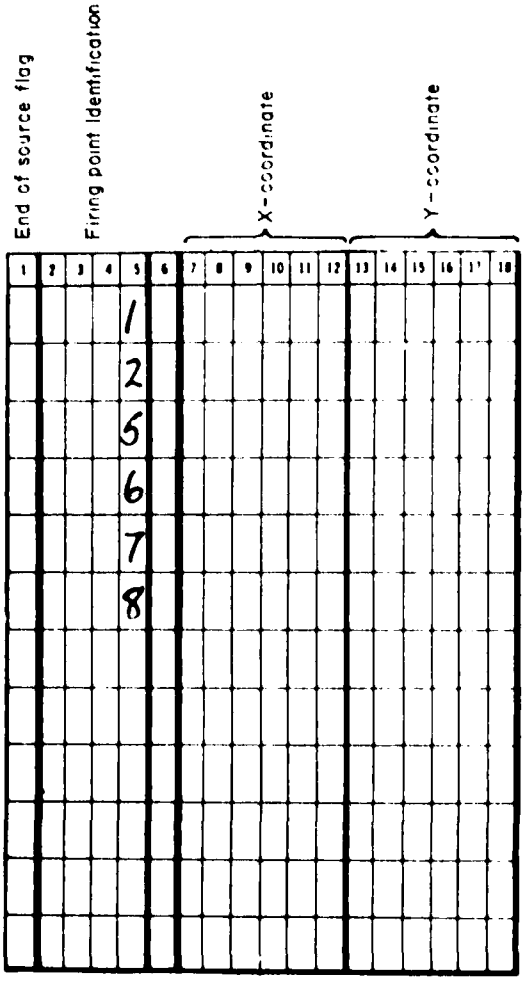

Figure 14. Target data sheet containing identification numbers.

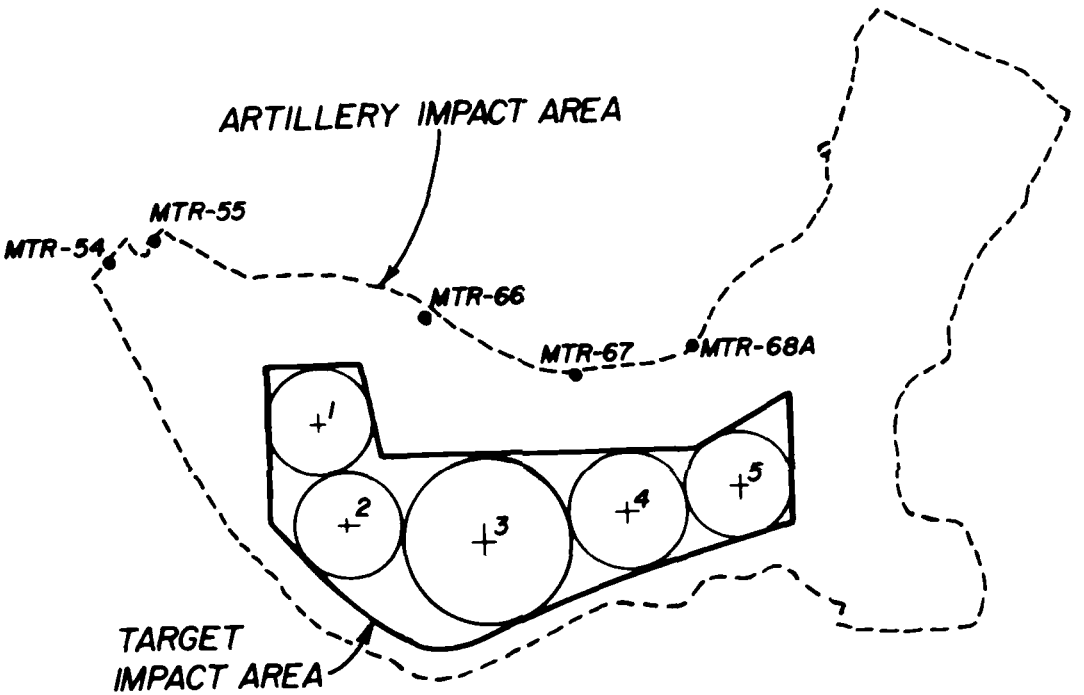

Figure 15. Target impact area covered by target groupings.

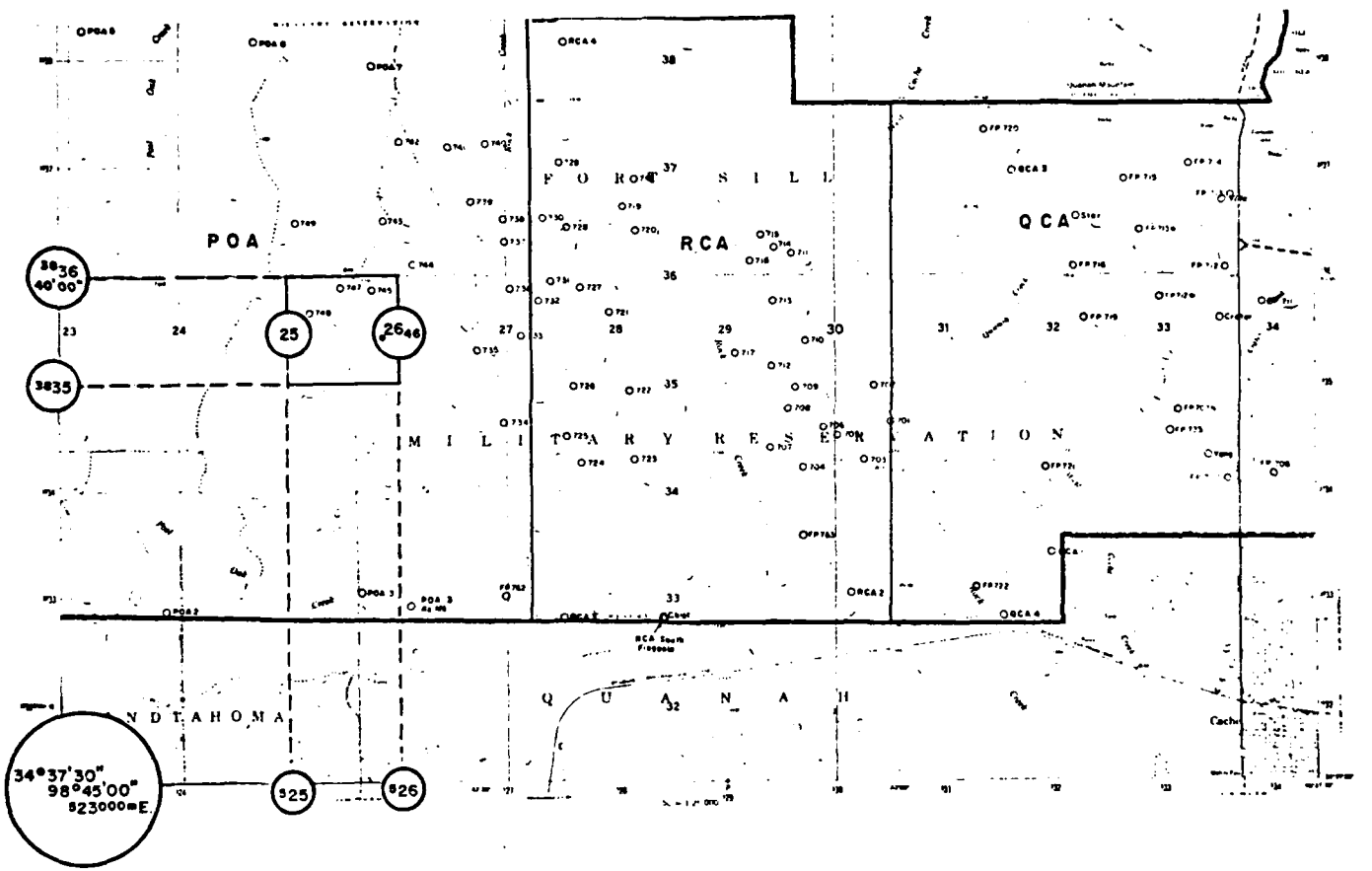

Figure 16. Coordinates read from a map.

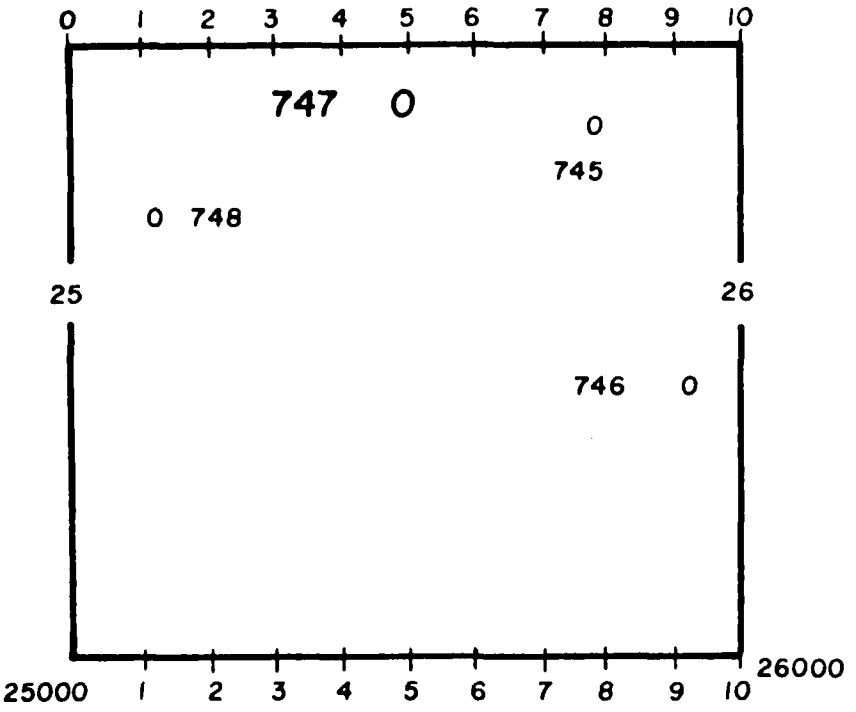

Figure 17. X coordinate read from a map.

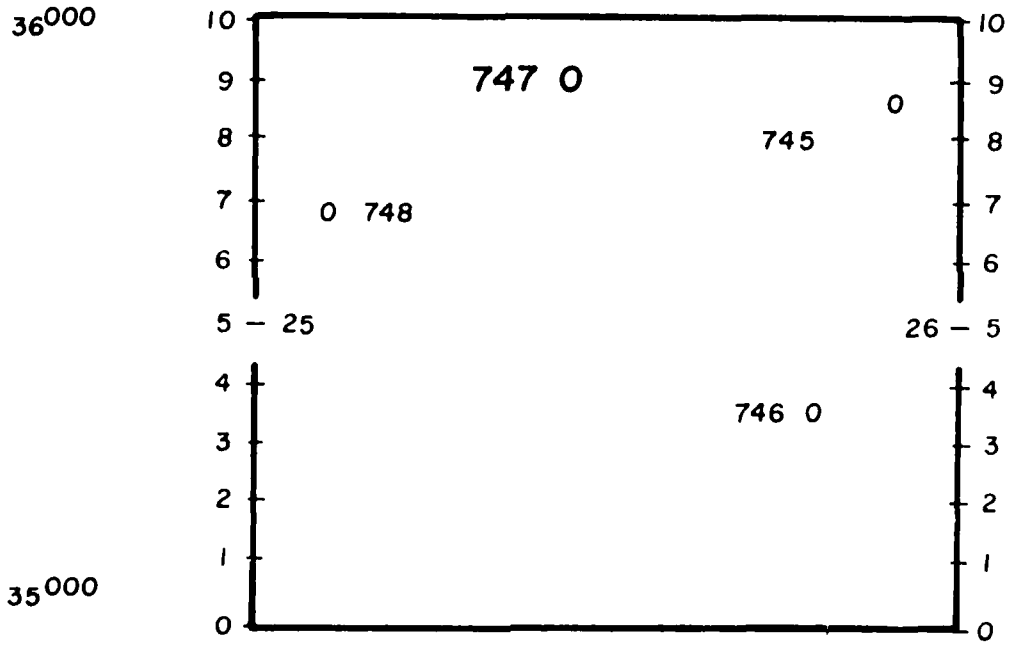

Figure 18. Y coordinate read from a map.

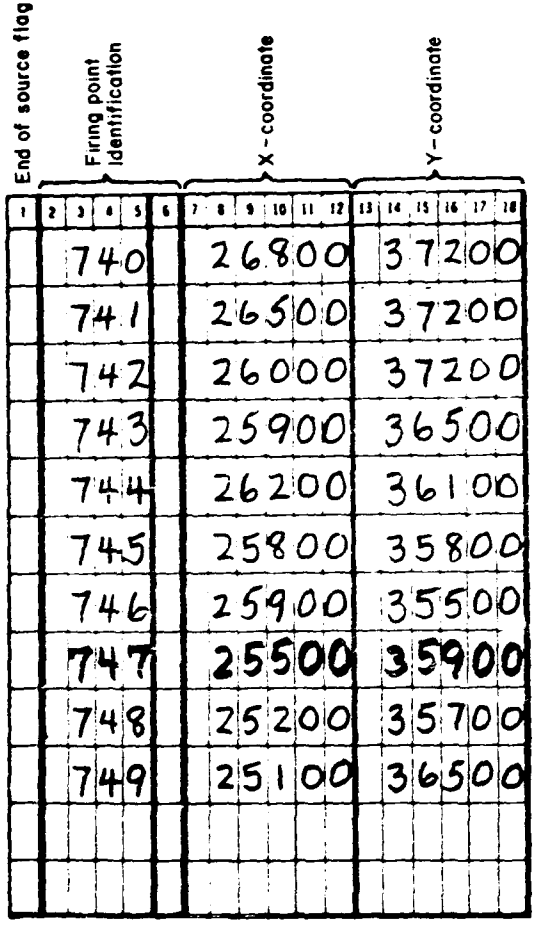

Figure 19. Target data sheet containing coordinates from Figures 17 and 18.

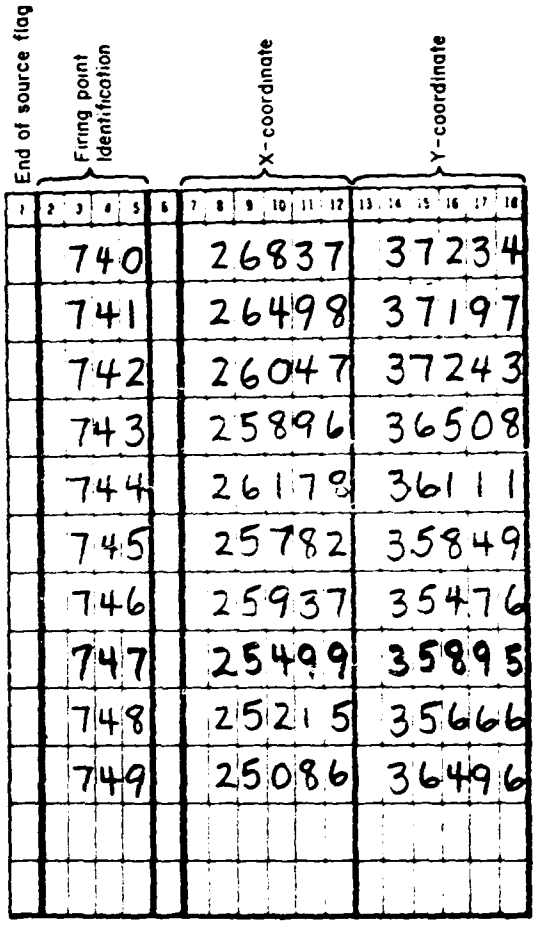

Figure 20. Target data sheet containing coordinates read from Table 1.

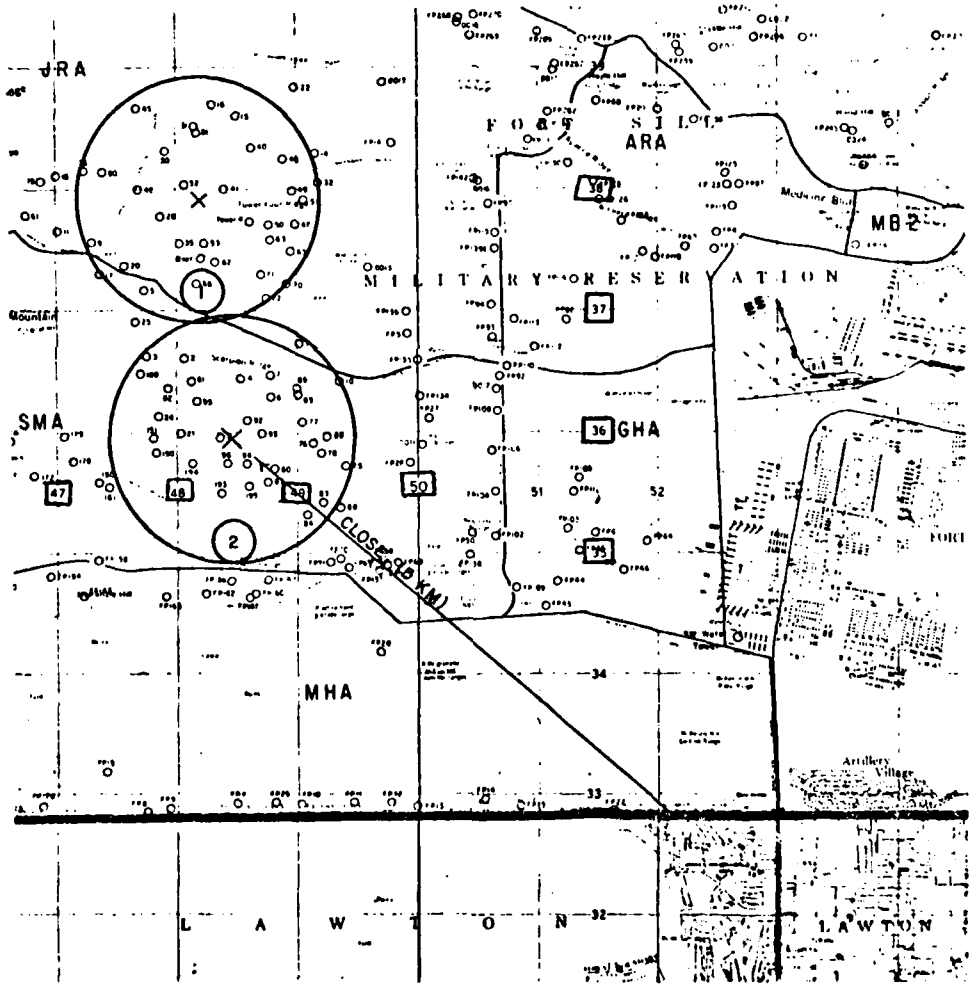

Figure 21. Coordinates of group targets read from map.

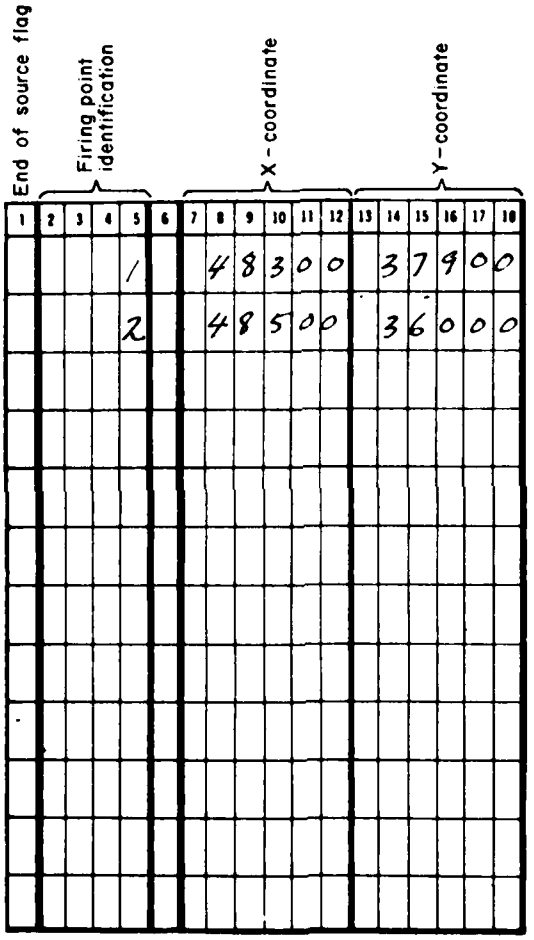

Figure 22. Target data sheet containing coordinates read from Figure 21.

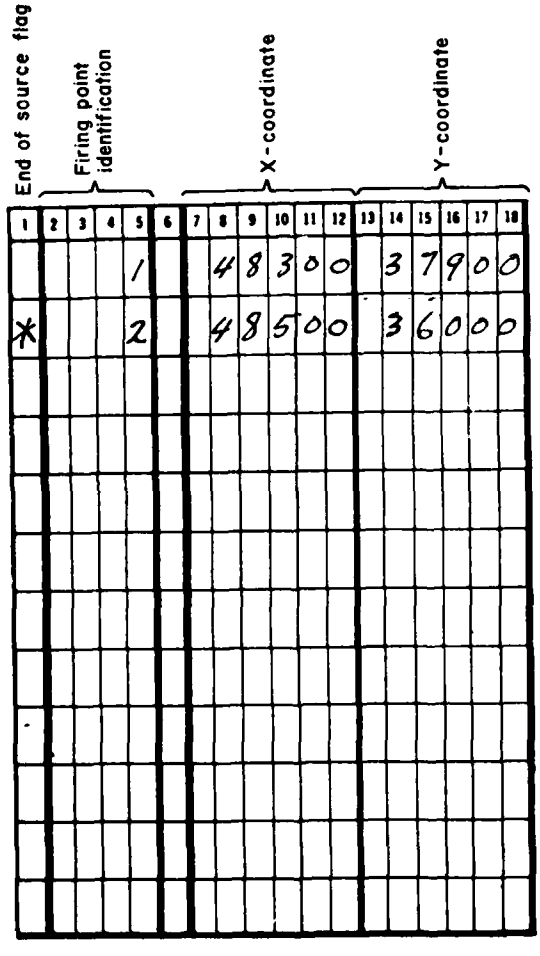

Figure 23. Completed target data sheet.

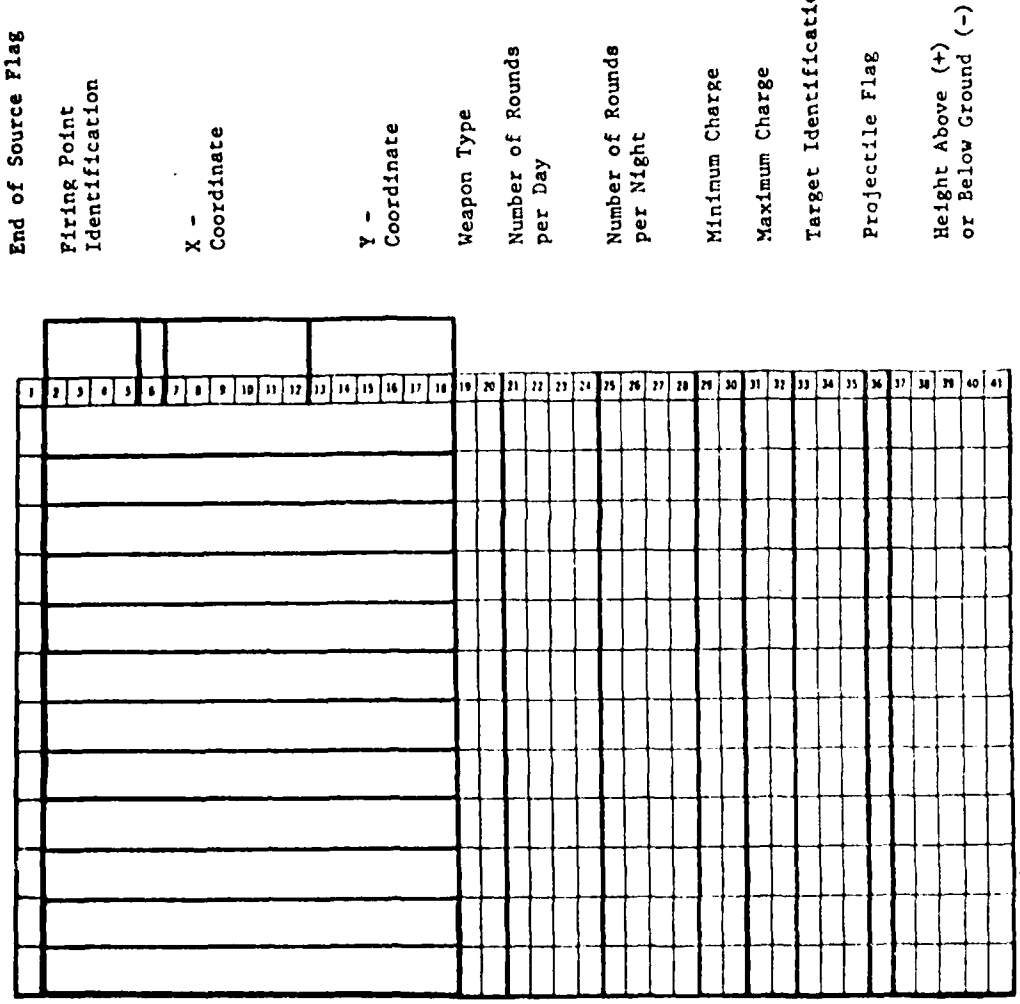

Figure 24. Firing point data form.

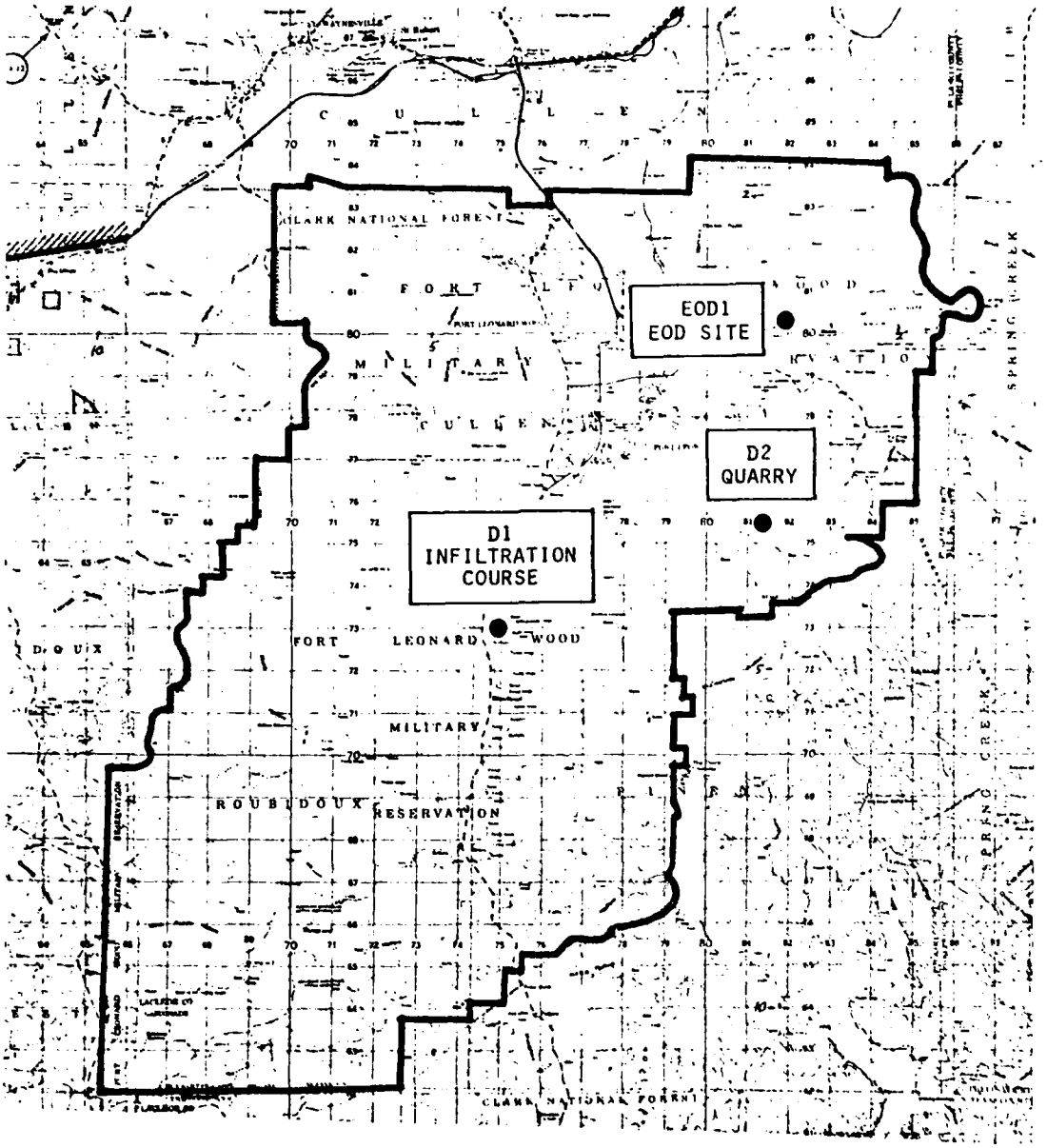

Figure 25. Map illustrating labeling of demolition sites.

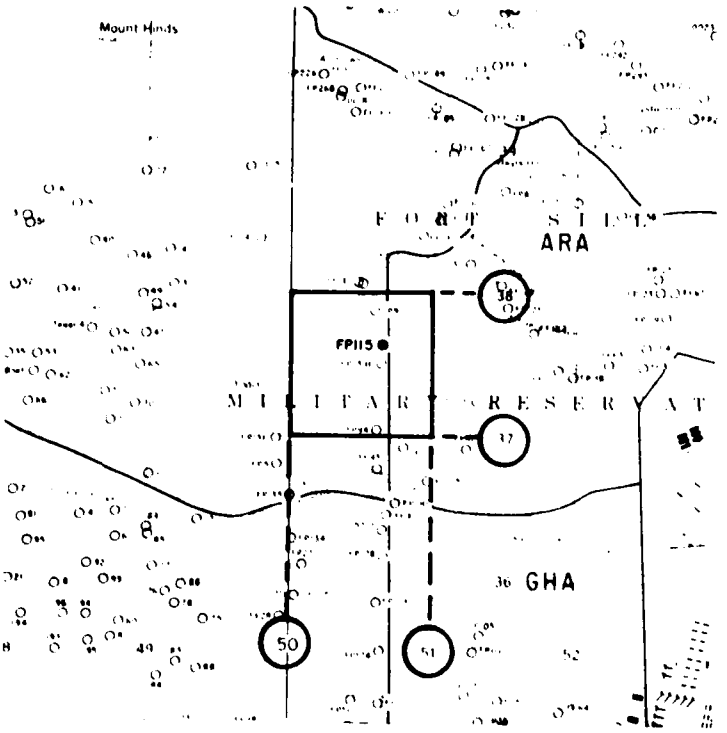

Figure 26. Coordinates read from a map.

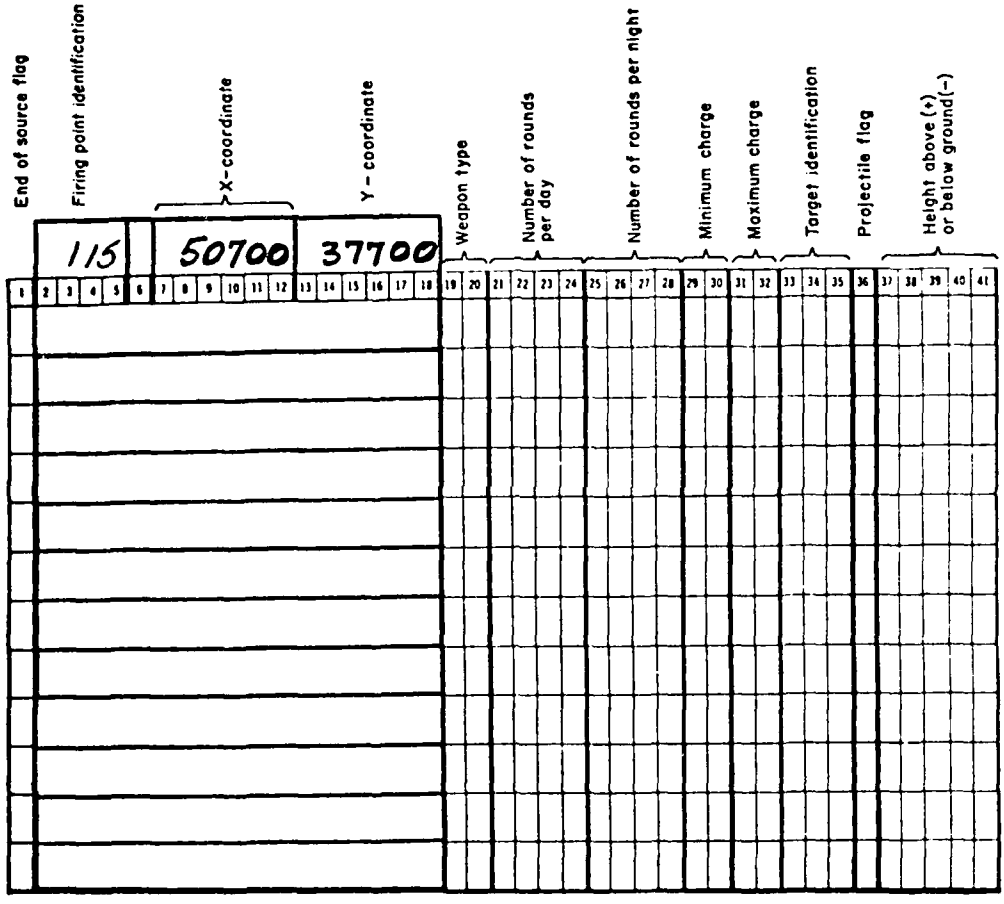

Figure 27. Firing point data form containing coordinates read from Figure 26.

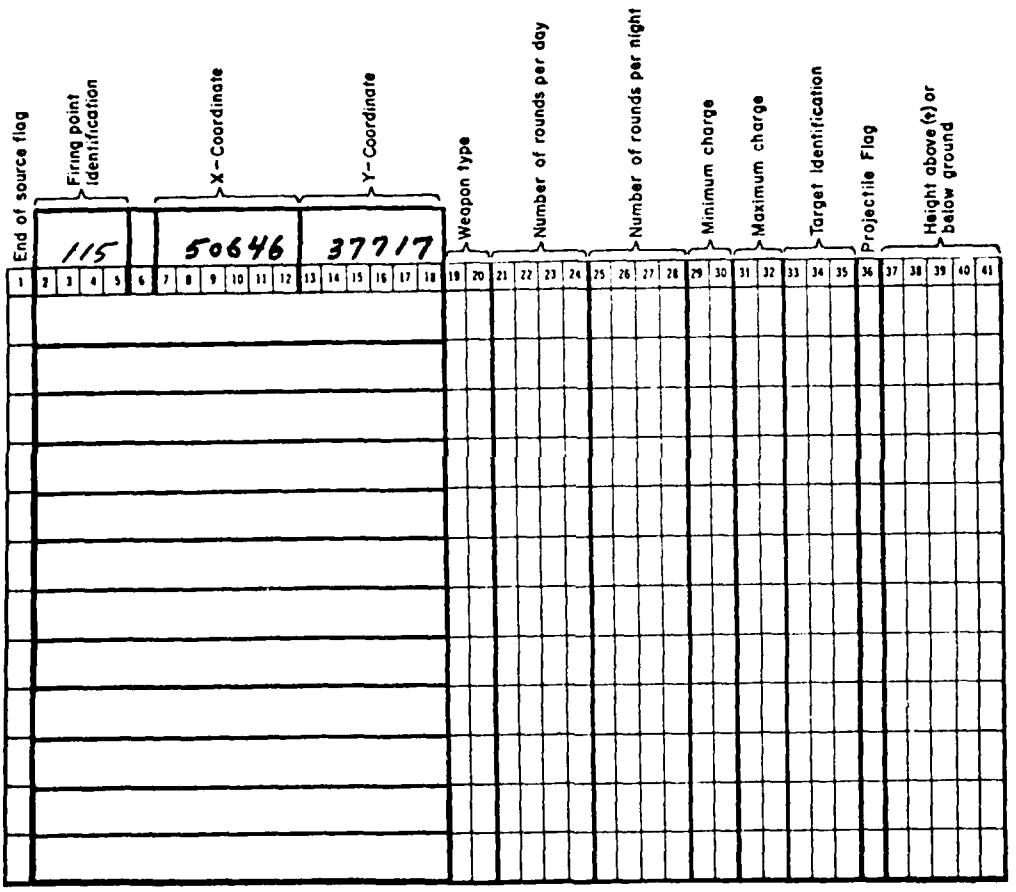

Figure 28. Firing point data form containing coordinates read from Table 2.

RANGE SAFETY CARD

UNIT STD ATC DATE-TIME GP 0830-1630 Fri 13 Apr 73

FIRING POINT 115 (5064 3771) AREA JRA SMA JRA

WEAPON 8"H AMMUNITION SH HE M57 FZM557 M564 M520

TYPE OF FIRE: High & Low Angle

DIRECTION LIMITS (Ref GN): LEFT 4920 MILS, RIGHT 5100 MILS

LOW ANGLE PD MINIMUM RANGE 1800 METERS, MINIMUM CHARGE 1

FUZE TI, VT & HI ANGLE MINIMUM RANGE 2100 METERS, MINIMUM CHARGE 1

MAXIMUM RANGE TO IMPACT 5500 METERS, MAXIMUM CHARGE 5

SPECIAL INSTRUCTIONS: Apply −5.5 seconds to Time of Flight corresponding to Range 1500 to establish Minimum Time for Fuze VT.

See reverse side for special instructions as appropriate to authorized weapons, fuzes, and projectiles.

Figure 29. Range safety card for firing point 115.

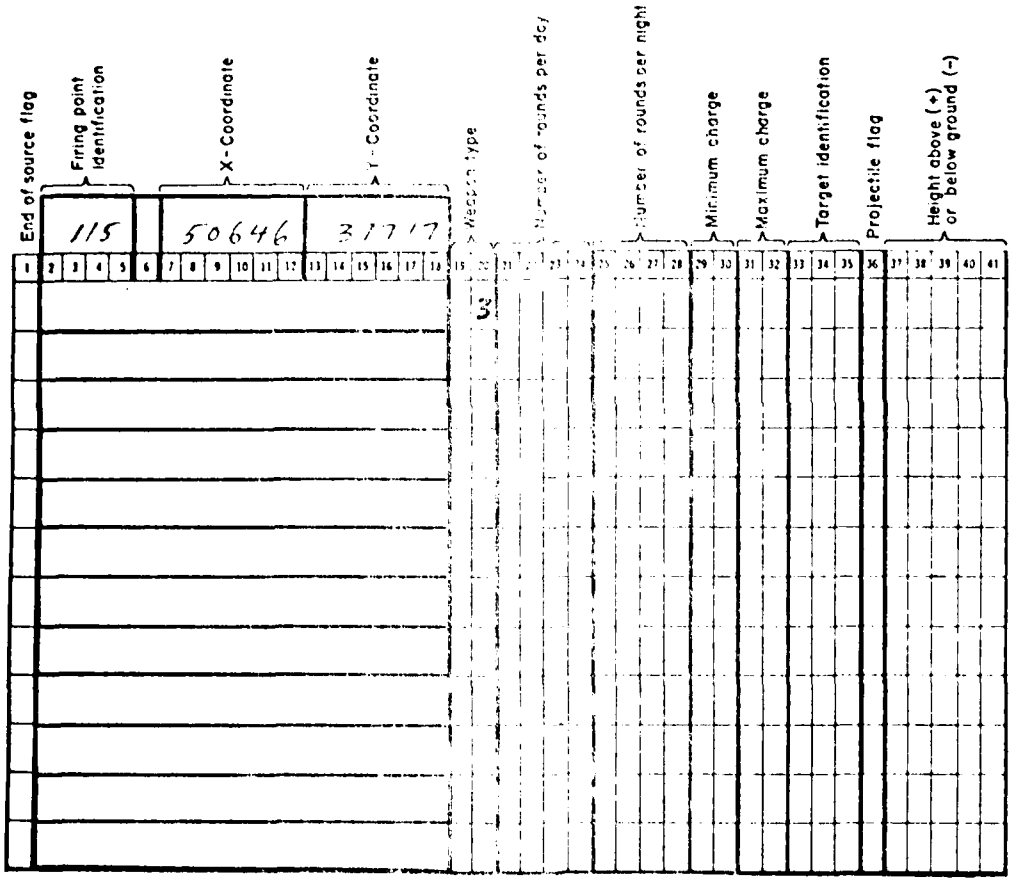

Figure 30. Firing point data form showing weapon type.

RANGE SAFETY CARD

UNIT/STR: ATC DATE-TIME GP: 0830-1630 Fri 13 Apr 73

FIRING POINT: 115 (5064 3771) AREA: JRA SMA JRA

WEAPON: 8"H AMMUNITION: SH HE M57 FZM557 M564 M520

TYPE OF FIRE: High & Low Angle

DIRECTION LIMITS: (Ref GN): LEFT 4920 MILS, RIGHT 5100 MILS

LOW ANGLE PD MINIMUM RANGE 1800 METERS, MINIMUM CHARGE 1

FUZE TI, VT & HI ANGLE MINIMUM RANGE 2100 METERS, MINIMUM CHARGE 1

MAXIMUM RANGE TO IMPACT 5500 METERS, MAXIMUM CHARGE 5

SPECIAL INSTRUCTIONS: Apply +5.5 seconds to Time of Flight corresponding to Range 1500 to establish Minimum Time for Fuze VT.

See reverse side for special instructions as appropriate to authorized weapons, fuzes, and projectiles.

Figure 31. Range safety card indicating charge range.

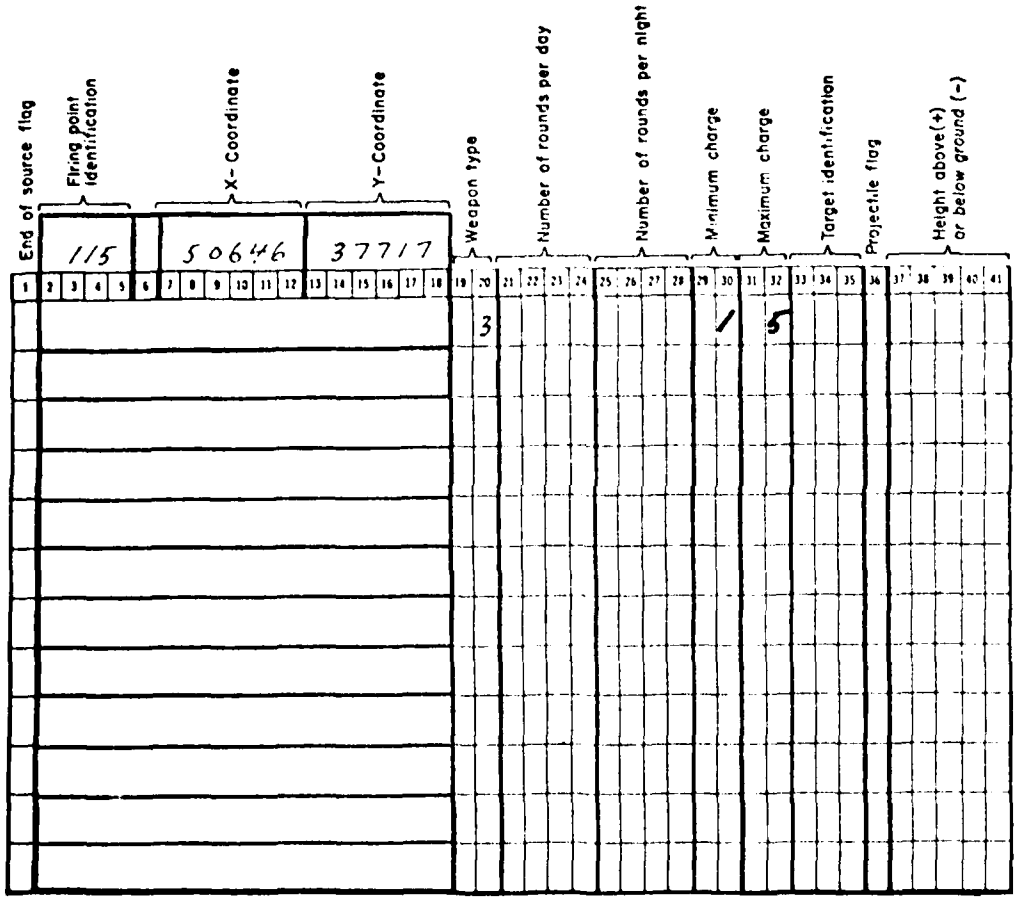

Figure 32. Firing point data form containing charge range for non-TNT weapons.

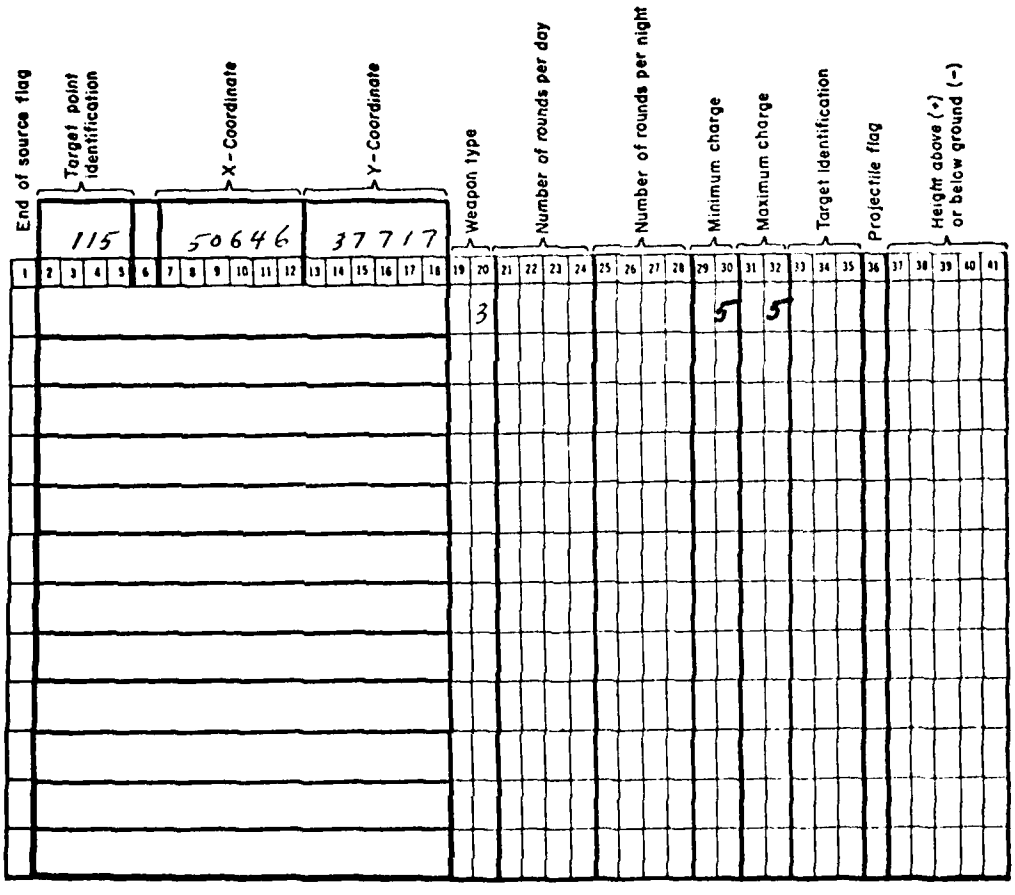

Figure 33. Firing point data form containing charge range for non-TNT weapons.

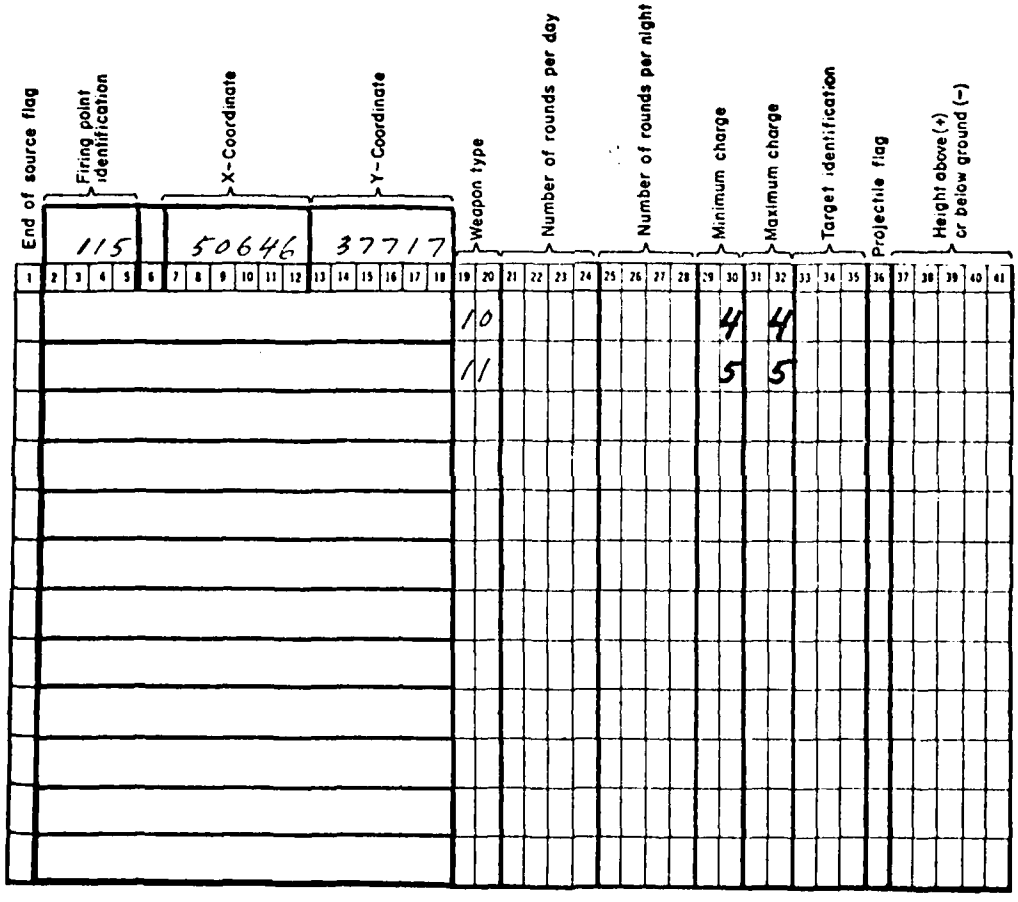

Figure 34. Firing point data form containing charge ranges for both large and small charges of C4.

RANGE: North | FIRING ORDER NR: 32 | RANGE CONTROL LOG | DATE: 2 May 73 | RANGE:

PROBLEM	UNIT	SCHEDULED TIME IN	SCHEDULED TIME OUT	FIRING POINT/GRID	OPR & PHONE LOCATION	OIC	ACTUAL TIME IN	ACTUAL TIME OUT	CHECKFIRE IMPOSED TIME NAME	CHECKFIRE LIFTED TIME/NAME	NUMBER PERSONS	ROUNDS FIRED	WEAPON
SPC	2/18	1300	1900	721	PVT Griffin	CPT Carson	1300	1830			50	49	105
SPC	2/18	2200	0200	721	PVT Williams	CPT Carson	2200	0200			48	76	105
SPC	2/18	0600	1100	721	PVT Coppins	CPT Carson	0600	1000			74	83	8
SPC	2/18	2000	0130	721	PVT Jones	CPT Carson	2000	0100			16	94	105

Figure 35. Range control log.

RANGE WEST	FIRING ORDER NR 813	RANGE CONTROL LOG										DATE	RANGE
PROBLEM	UNIT	SCHEDULED TIME IN	SCHEDULED TIME OUT	FIRING POINT/GRID	OPR & PHONE LOCATION	OIC	ACTUAL TIME IN	ACTUAL TIME OUT	CEASEFIRE IMPOSED TIME NAME	CEASEFIRE LIFTED TIME/NAME	NUMBER PERSONS	ROUNDS FIRED	WEAPON
GED 742	2/18	0500	1300	7	PFC MADDEN	CPT SISNEY	0830	1200			58	40	105H
DAILY ROUND TOTAL PER WEAPON:		105H	155H	8"H	175G	4.2"	81 MORT	90mm	40mm	2.75"			
		14.5mm	MJ RKT	OTHER									

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Figure 36. Range control log for fire occurring entirely during the day.

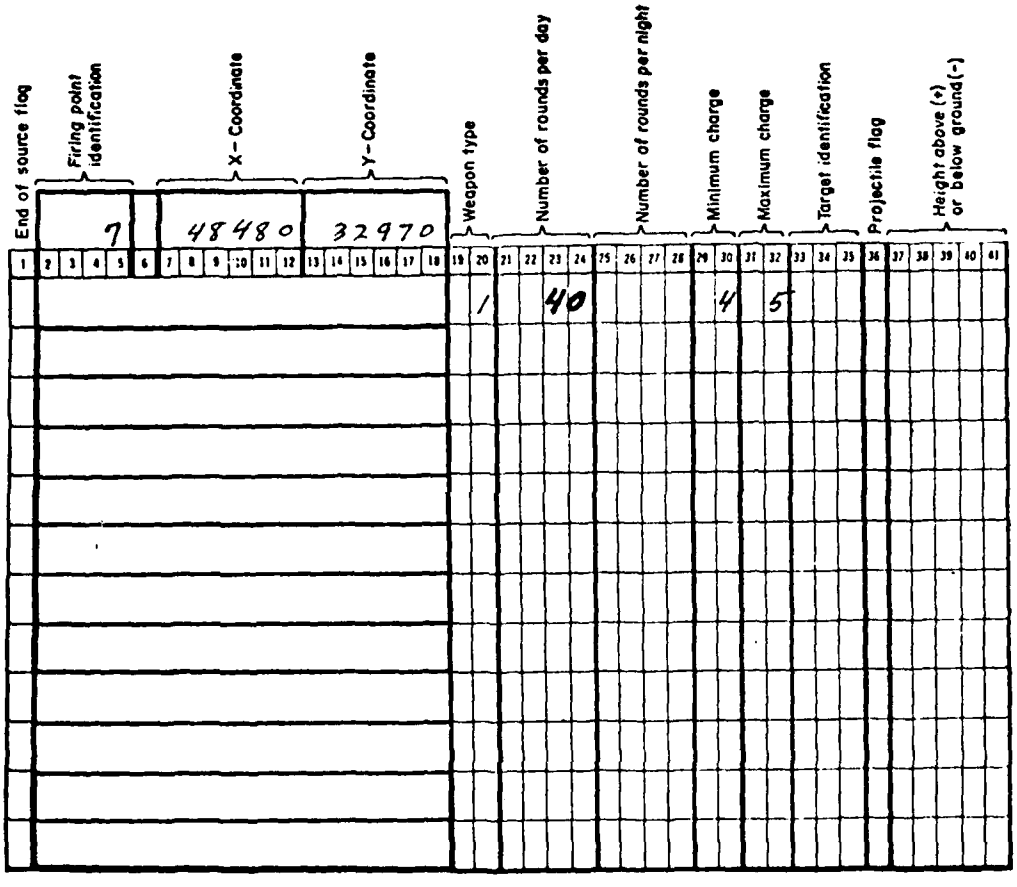

Figure 37. Firing point data form for fire occurring entirely during the day.

RANGE	FIRING ORDER NR	RANGE CONTROL LOG									DATE	RANGE
West	813										13 Apr 73	

PROBLEM	UNIT	SCHEDULED TIME IN	SCHEDULED TIME OUT	FIRING POINT/GRID	OPR & PHONE LOCATION	OIC	ACTUAL TIME IN	ACTUAL TIME OUT	CHECKFIRE IMPOSED TIME NAME	CHECKFIRE LIFTED TIME/NAME	NUMBER PERSONS	ROUNDS FIRED	WEAPON
LTD	212	C830	2400	434	CPT Smith	COL Weissinger	2200	2330			70	20	105

Figure 38. Range control log for fire occurring entirely during the night.

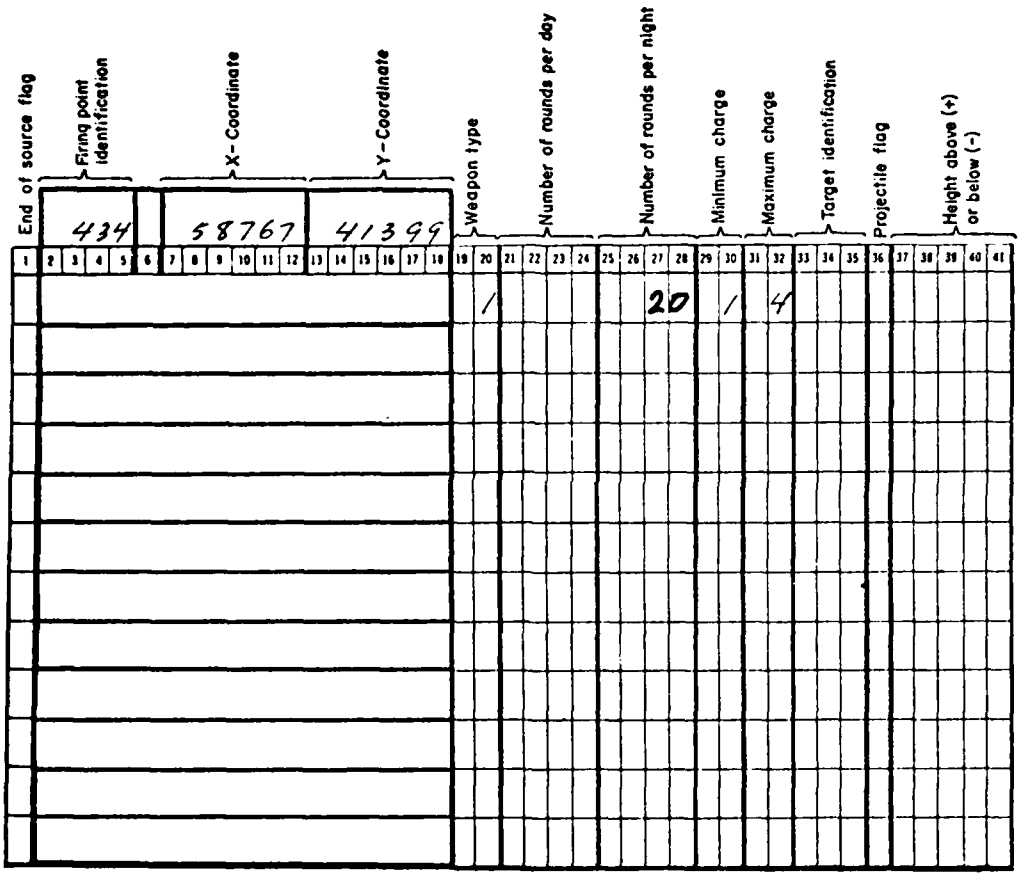

Figure 39. Firing point data form for fire occurring entirely during the night.

RANGE West	FIRING ORDER NR 813	RANGE CONTROL LOG									DATE 13 Apr 73	RANGE
PROBLEM	UNIT	SCHEDULED TIME		FIRING POINT/GRID	OPR & PHONE LOCATION	OIC	ACTUAL TIME		CHECKFIRE		NUMBER PERSONS	ROUNDS FIRED	WEAPON
		IN	OUT				IN	OUT	IMPOSED TIME NAME	LIFTED TIME/NAME			
GED 742	2/18	0500	1200	057E	PVT Keehn	CPT Blackman	0500	1100			80	85	105

Figure 40. Range control log for fire overlapping between day and night.

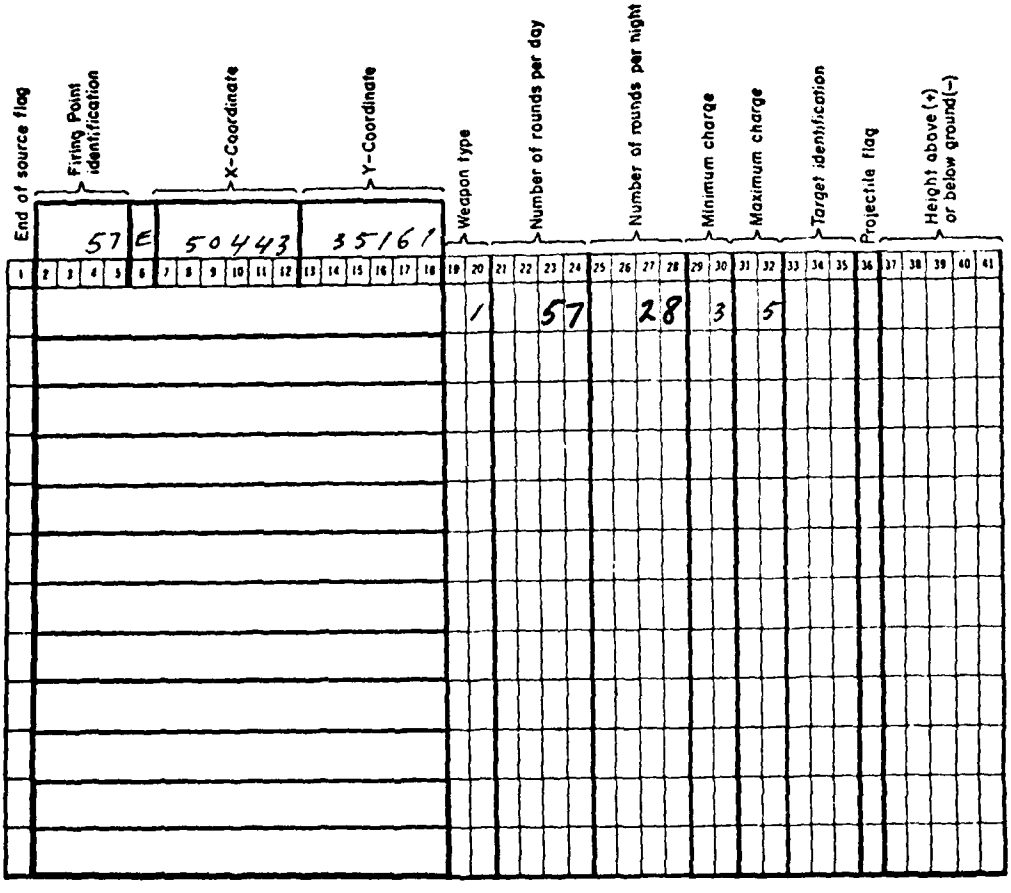

Figure 41. Firing point data form indicating overlapping fire.

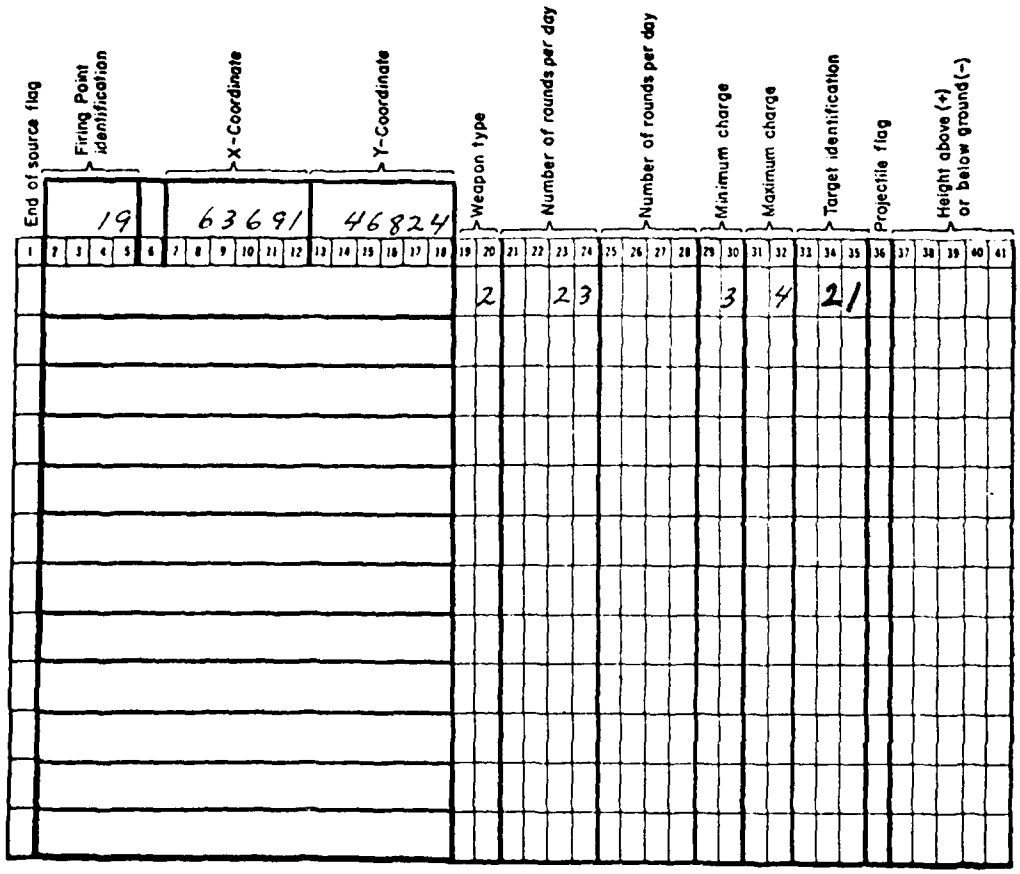

Figure 42. Firing point data form showing the target identification number.

RANGE SAFETY CARD

OPERATOR ATC DATE-TIME GP: 0830-1630 Fri 13 Apr 73

FIRING POINT 115 (5064 3771) AREA: JRA SMA JRA

WEAPON 8"H AMMUNITION: SH HE M57 FZM557 M564 M520

TYPE OF FIRE High & Low Angle

DIRECTION LIMITS (Ref GN): LEFT 4920 MILS, RIGHT 5100 MILS

LOW ANGLE PD MINIMUM RANGE 1800 METERS, MINIMUM CHARGE 1

FUZE TI, VT & HI ANGLE MINIMUM RANGE 2100 METERS, MINIMUM CHARGE 1

MAXIMUM RANGE TO IMPACT 3500 METERS, MAXIMUM CHARGE 5

SPECIAL INSTRUCTIONS: Apply +5.5 seconds to Time of Flight corresponding to Range 1500 to establish Minimum Time for Fuze VT.

See reverse side for special instructions as appropriate to authorized weapons, fuzes, and projectiles.

Figure 43. Range safety card indicating range and direction.

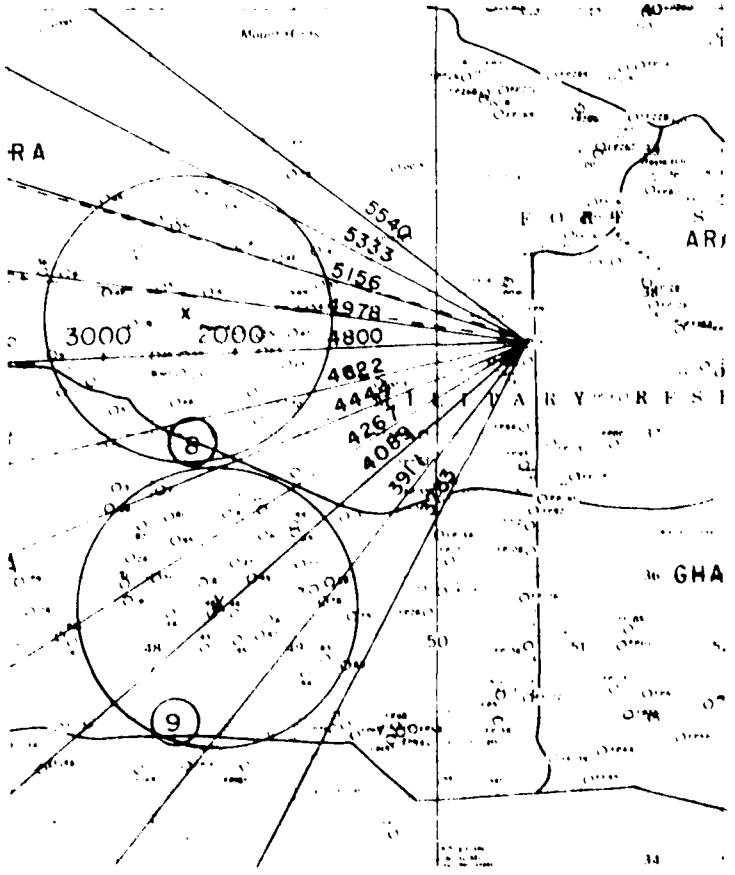

Figure 44. Map with protractor overlay.

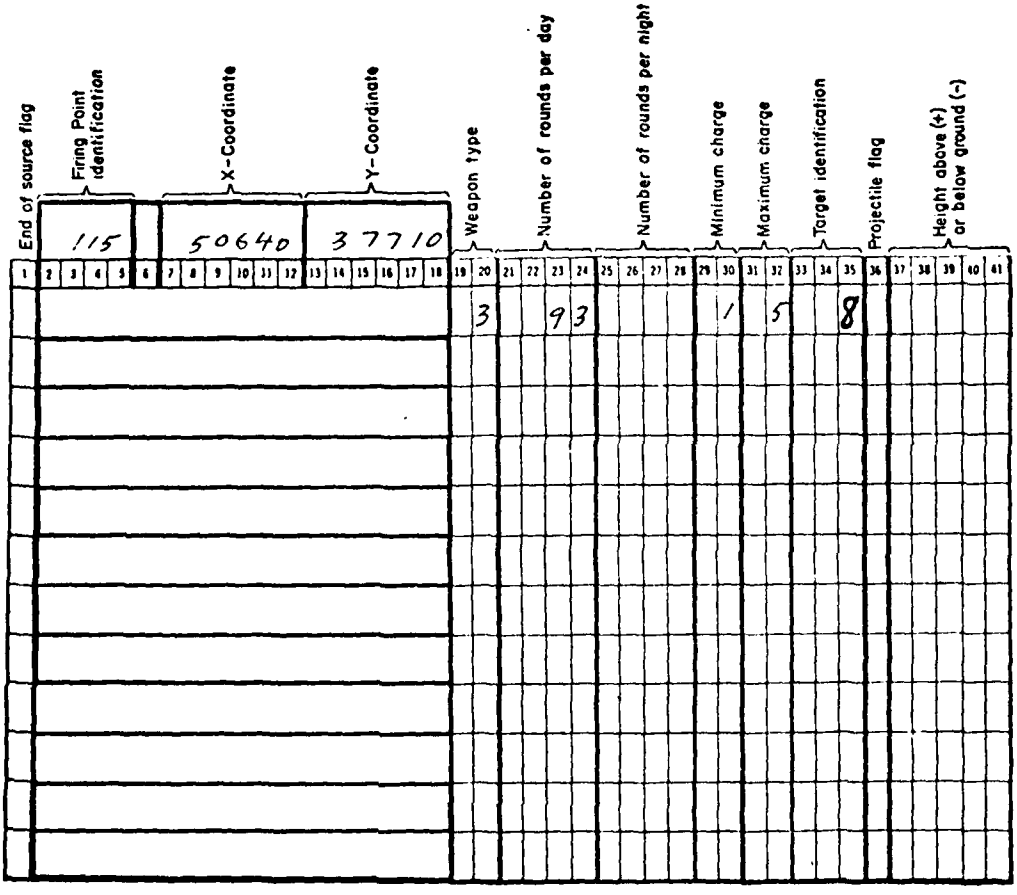

Figure 45. Firing point data form with target identification number.

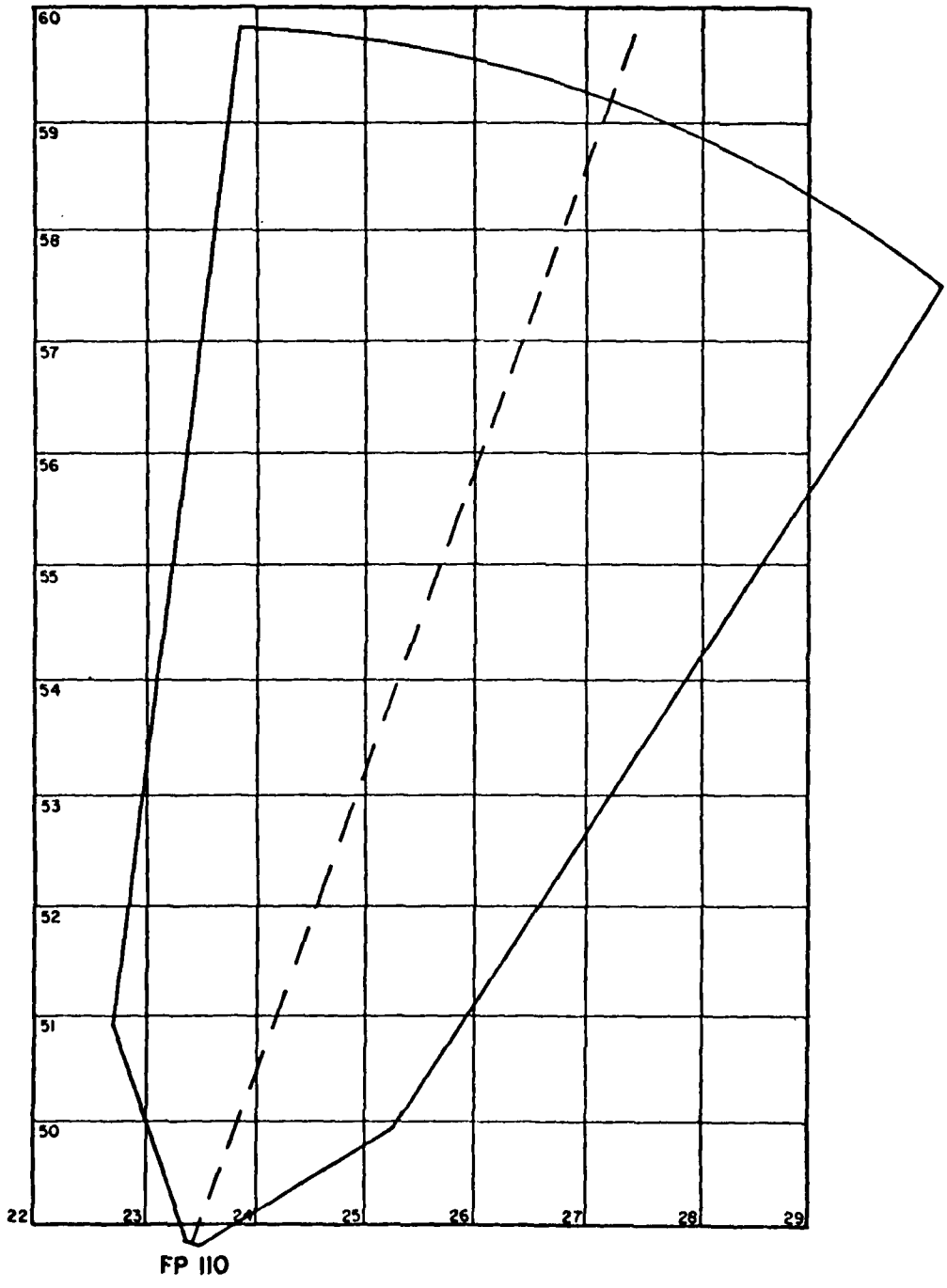

Figure 46. Typical safety fan with centerline.

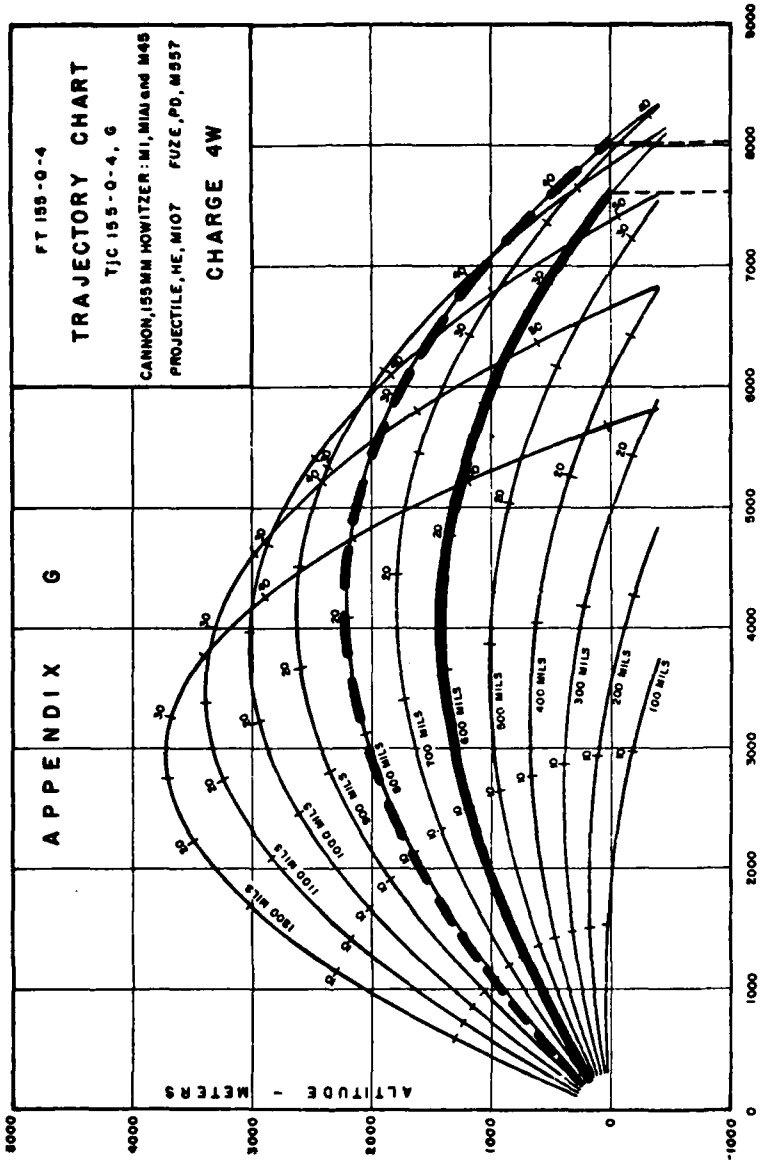

Figure 47. Sample trajectory chart (155-mm howitzer, charge weight 4).

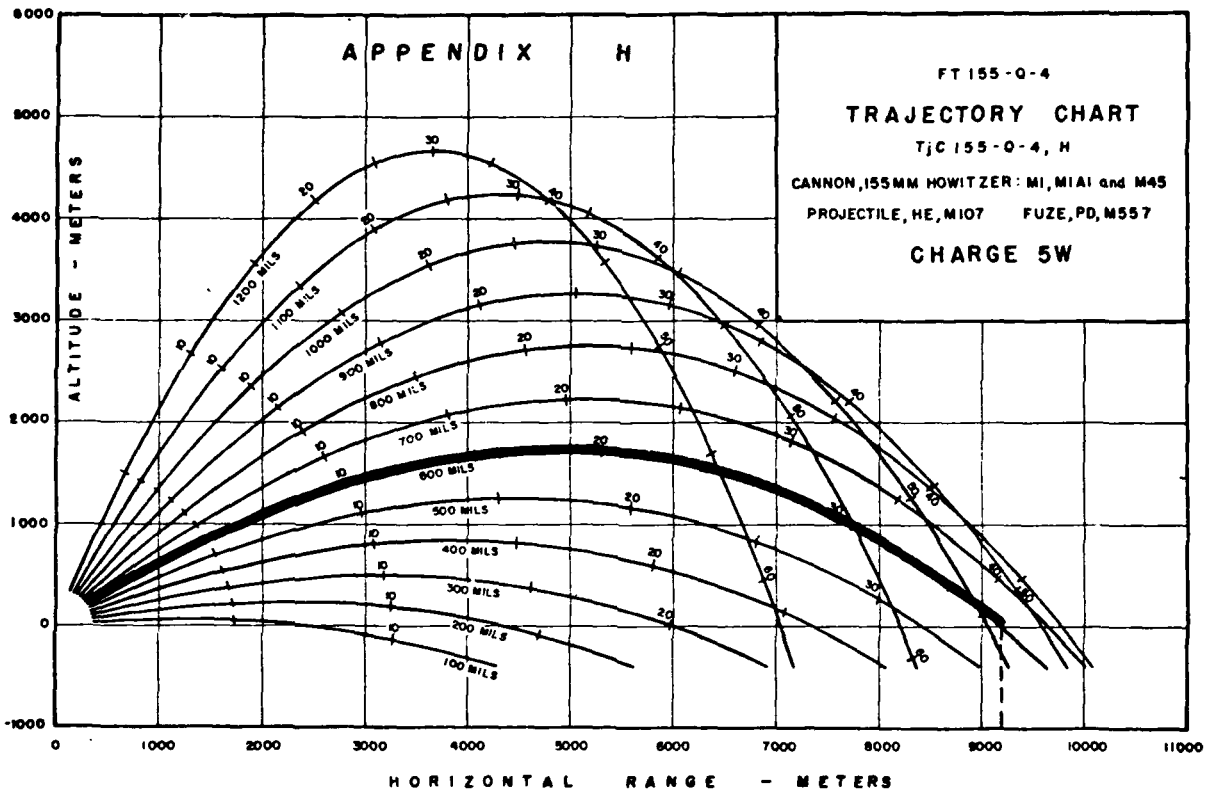

Figure 43. Sample trajectory chart (155-mm howitzer, charge weight 5).

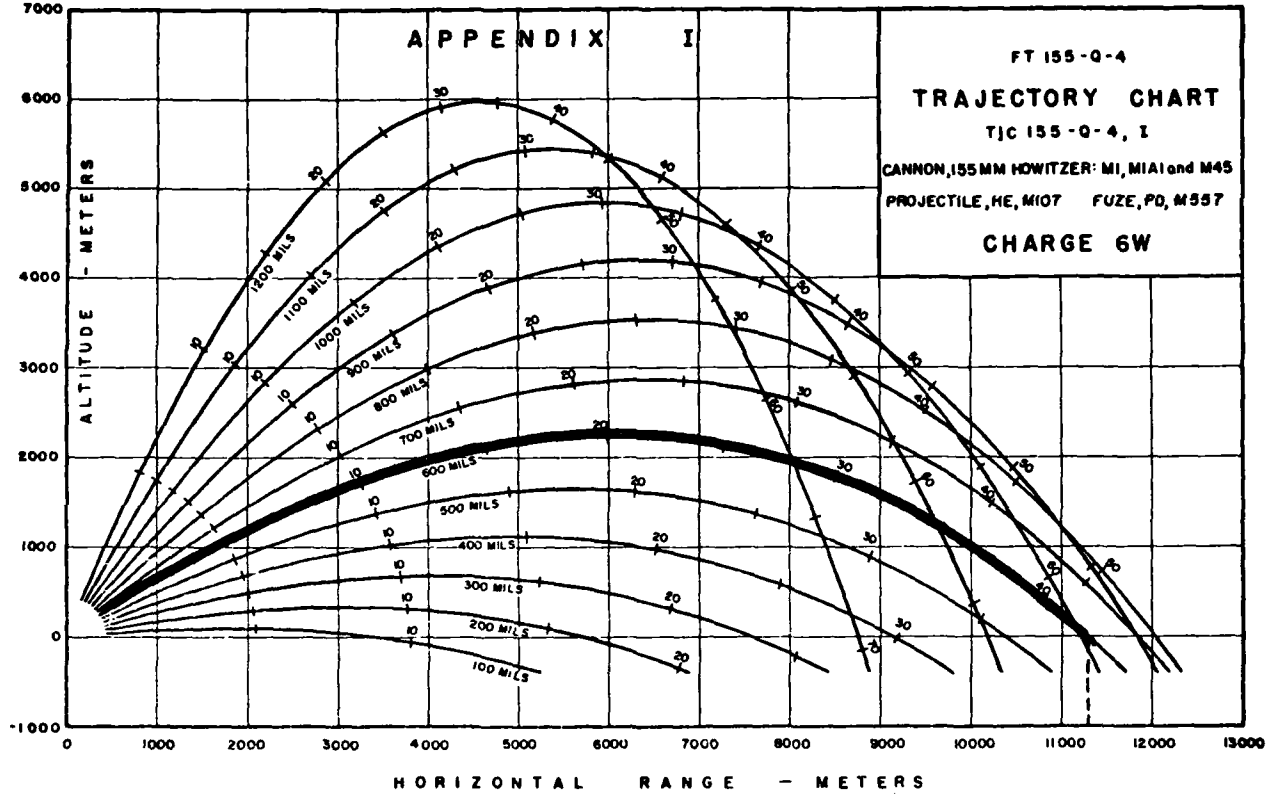

Figure 49. Sample trajectory chart (155-mm howitzer, charge weight 6).

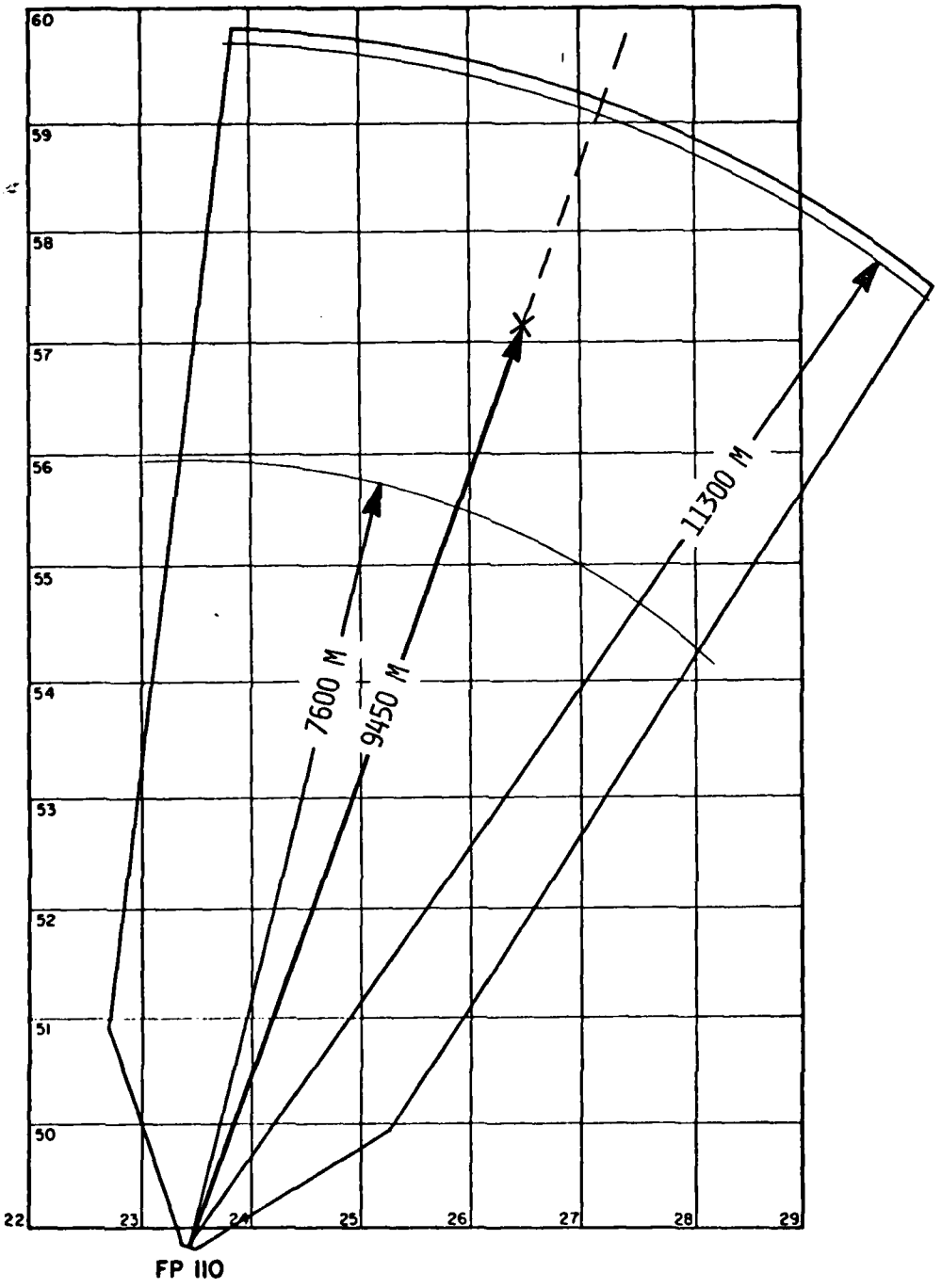

Figure 50. Target point determined from safety fan and trajectory charts.

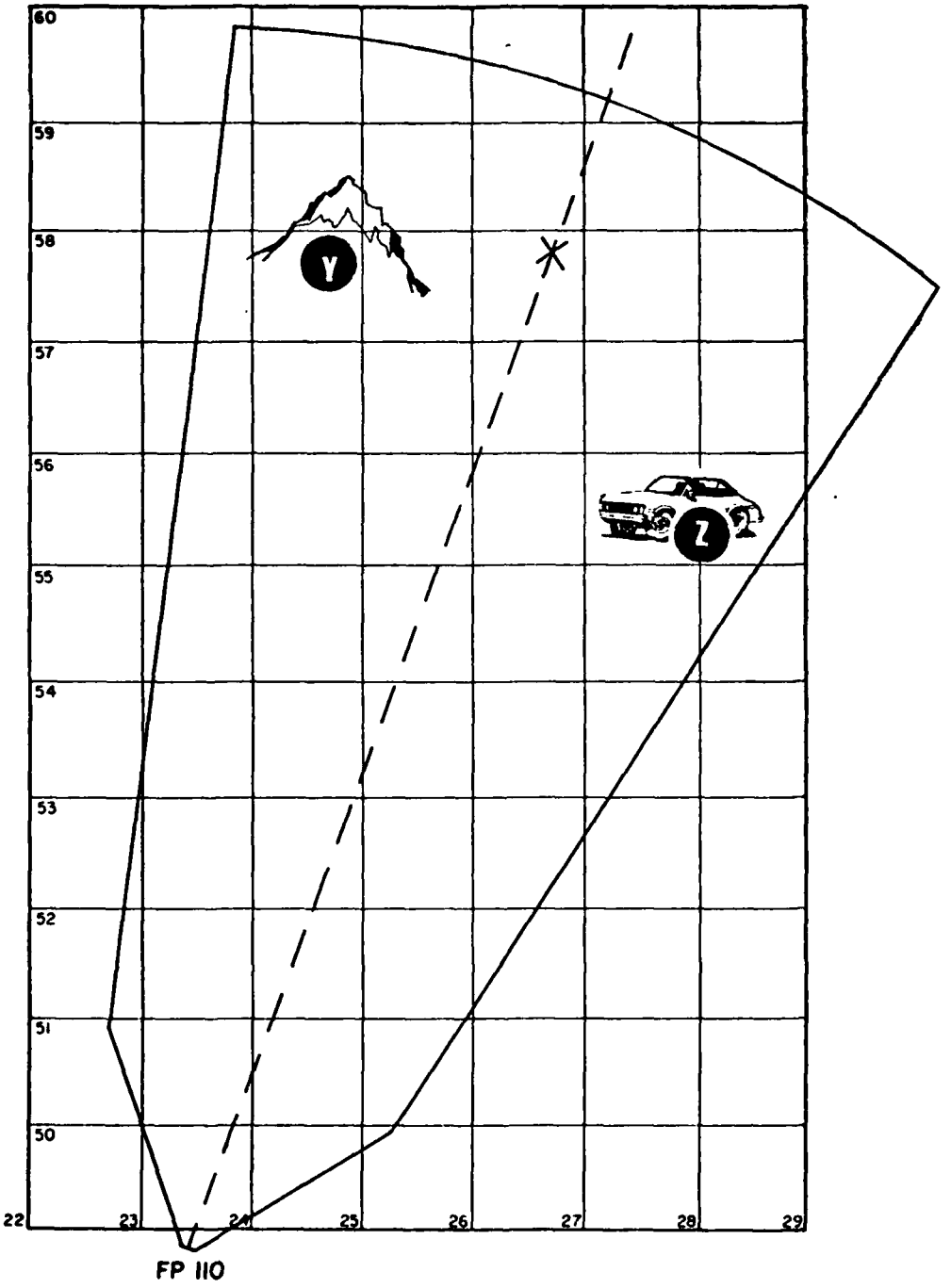

Figure 51. Two target points after consulting range personnel.

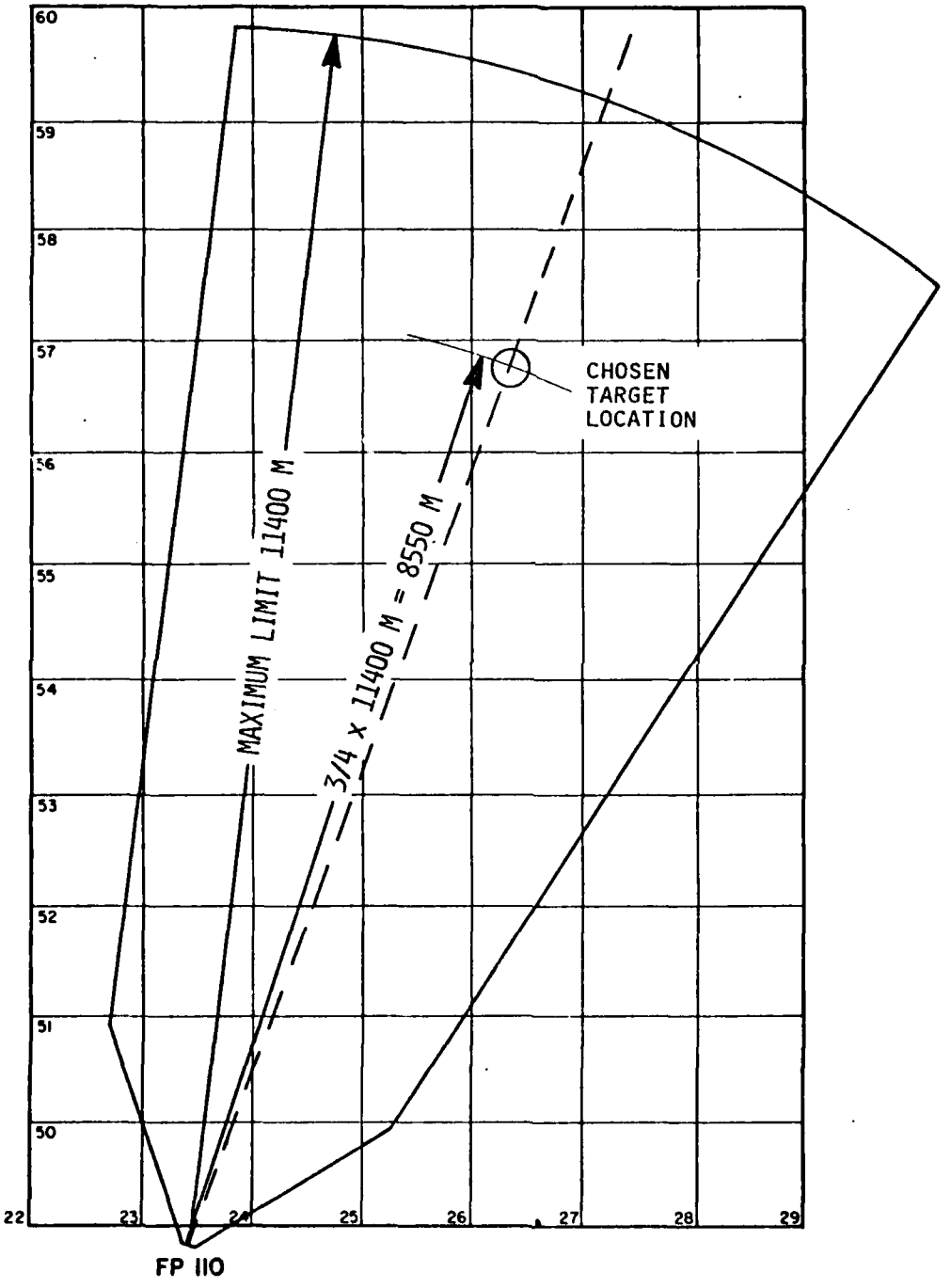

Figure 52. Estimated target point along centerline of safety fan.

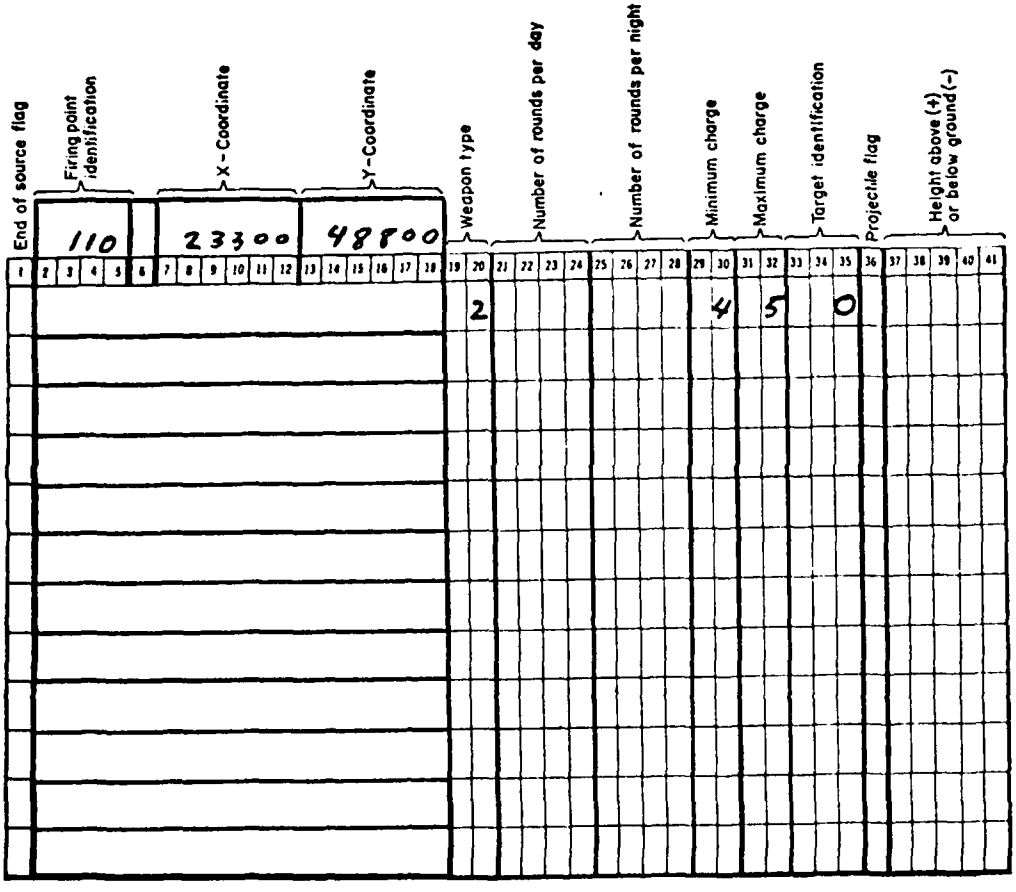

Figure 53. Firing point data form with charge ranges.

RANGE SAFETY CARD

UNIT/STR: 2/18th DATE-TIME GP: 0500 - 1300 Wed 2 May 73

FIRING POINT: 7 AREA: MHA SMA JRA

WEAPON: 8"H AMMUNITION: SH HE M57 FZM564 M520 M514

TYPE OF FIRE: High & Low Angle

DIRECTION LIMITS: (Ref GN): LEFT 6222 MILS, RIGHT 0179 MILS

LOW ANGLE PD MINIMUM RANGE 3200 METERS, MINIMUM CHARGE 1

FUZE TI, VT & HI ANGLE MINIMUM RANGE 3500 METERS, MINIMUM CHARGE 1

MAXIMUM RANGE TO IMPACT 5000 METERS, MAXIMUM CHARGE 4

SPECIAL INSTRUCTIONS: Apply +5.5 seconds to Time of Flight corresponding to Range 1500 to establish Minimum Time for Fuze VT.

See reverse side for special instructions as appropriate to authorized weapons, fuzes, and projectiles.

Figure 54. Range safety card with direction limits and ranges marked.

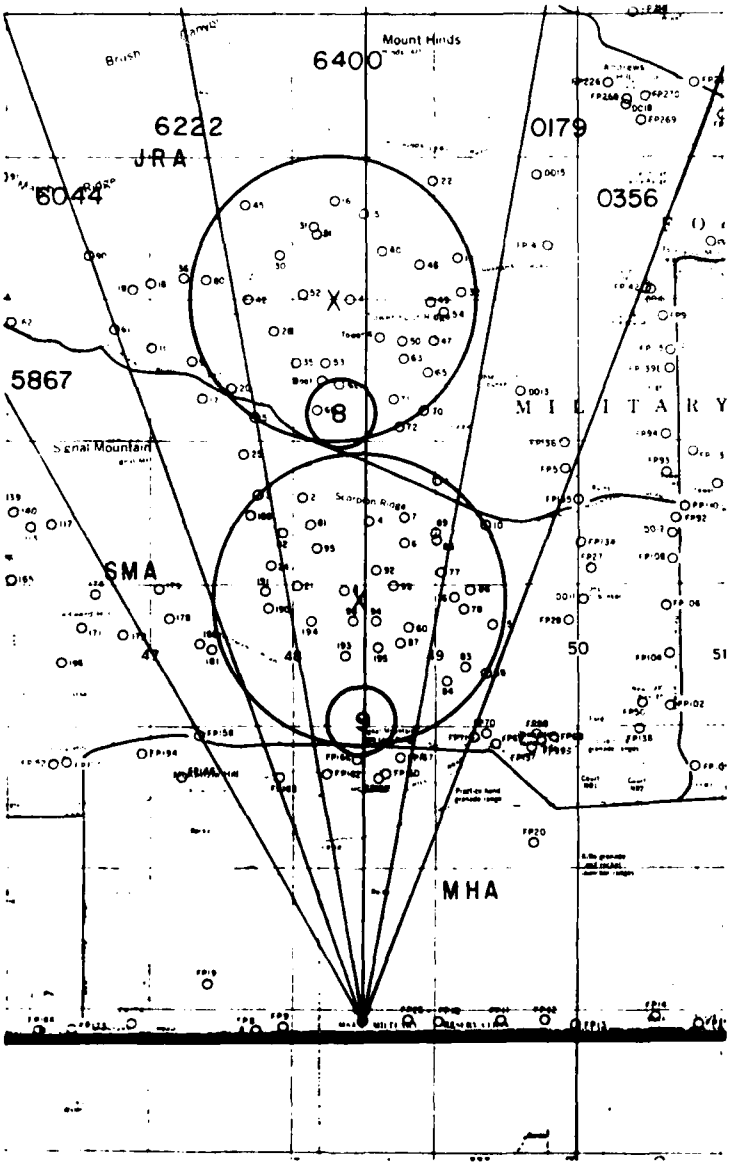

Figure 55. Map with protractor overlay.

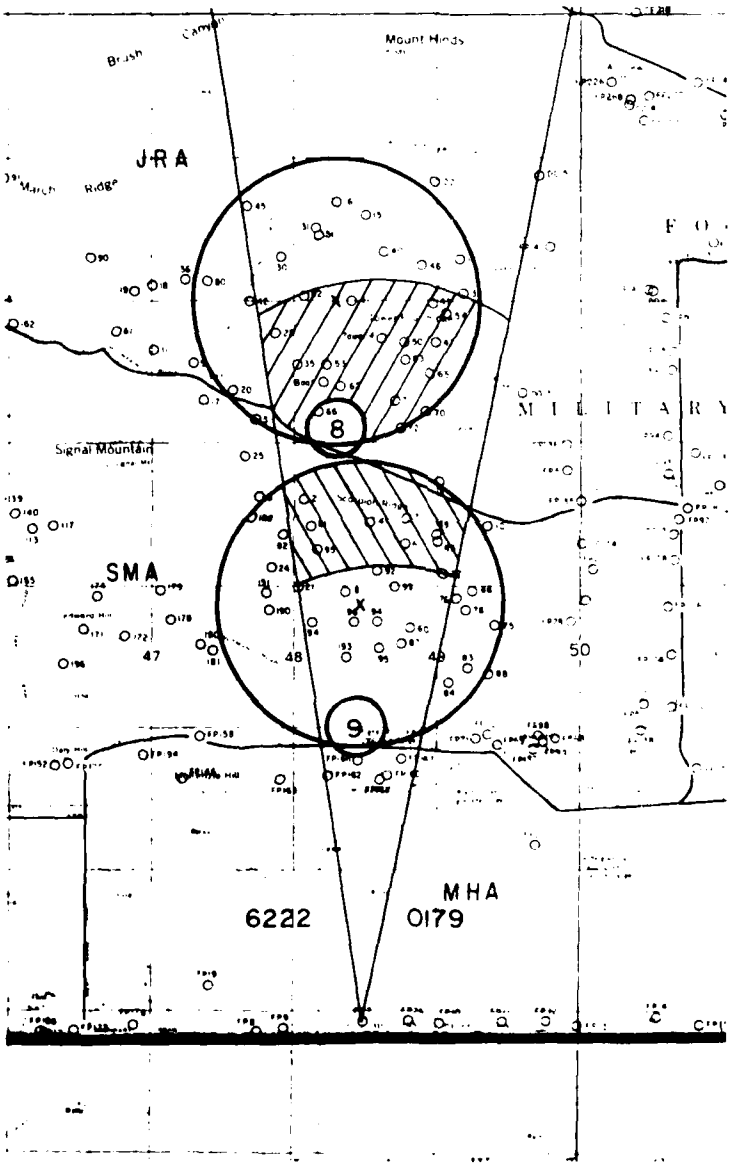

Figure 56. Map illustrating direction limits and ranges.

AD-A080 429 CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAIGN IL F/G 13/2
COMPILATION OF OPERATIONAL BLAST NOISE DATA.(U)
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UNCLASSIFIED CERL-TR-N-82 NL

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RANGE	FIRING ORDER NR	RANGE CONTROL LOG	DATE	RANGE
West	813		2 May 73	

PROBLEM	UNIT	SCHEDULED TIME IN	SCHEDULED TIME OUT	FIRING POINT/GRID	OPR & PHONE LOCATION	OIC	ACTUAL TIME IN	ACTUAL TIME OUT	CHECKFIRE IMPOSED TIME NAME	CHECKFIRE LIFTED TIME/NAME	NUMBER PERSONS	ROUNDS FIRED	WEAPON
GED 742	2/18	0500	1300	7	DFC Madden	CPT Sisney	0500	1300			58	40	8" H

Figure 57. Range control log showing actual time and rounds fired.

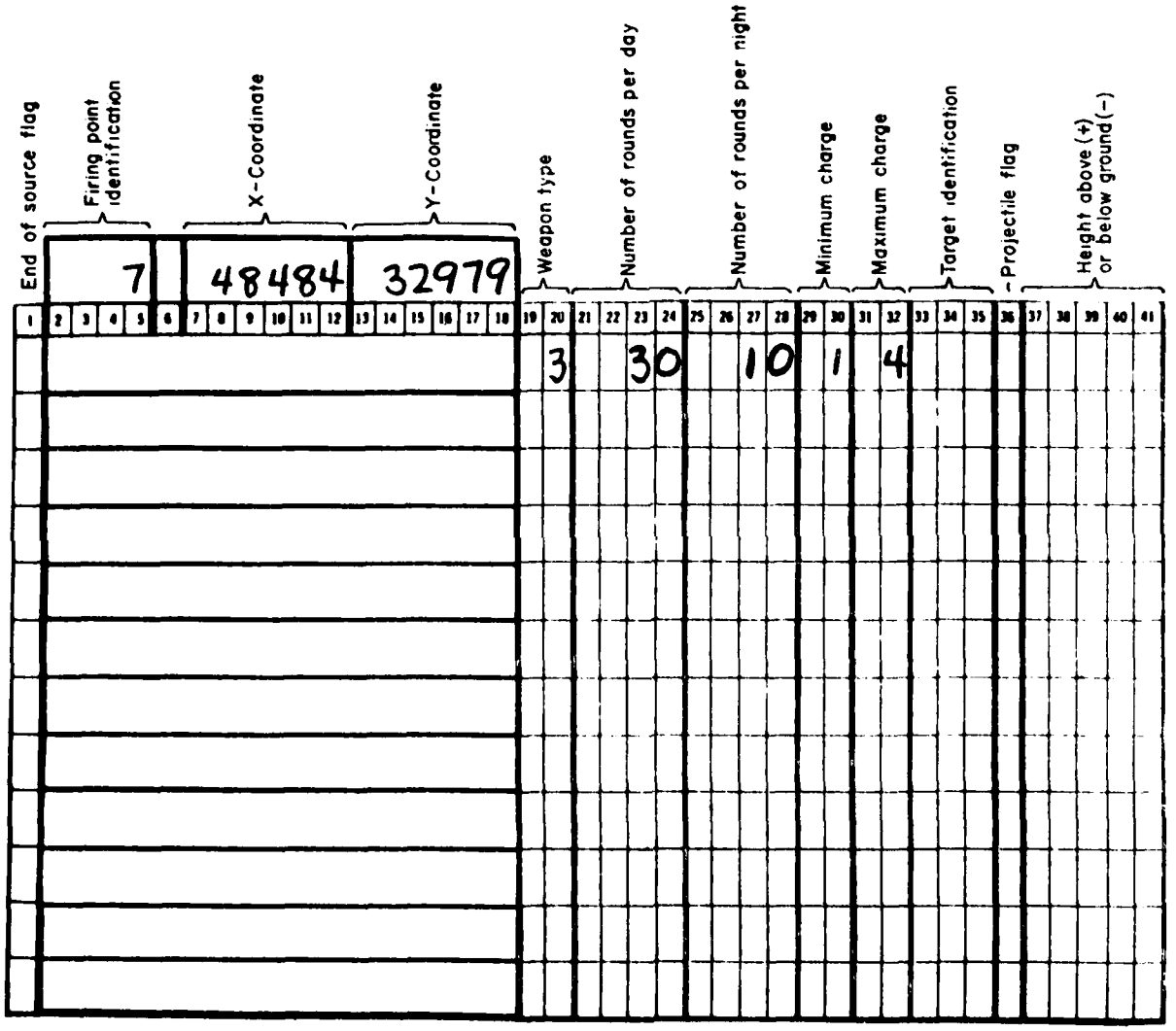

Figure 58. Firing point data form with number of rounds entered from Figure 57.

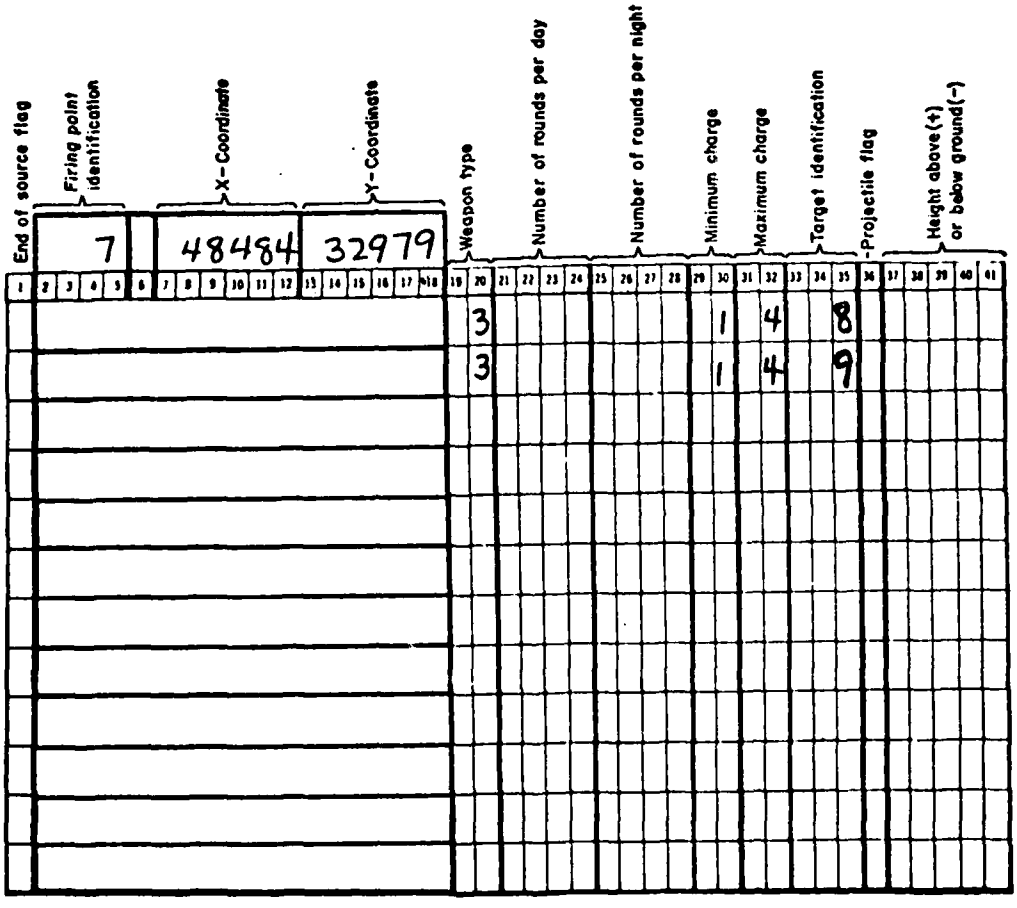

Figure 59. Firing point data form with weapon and charge range copied.

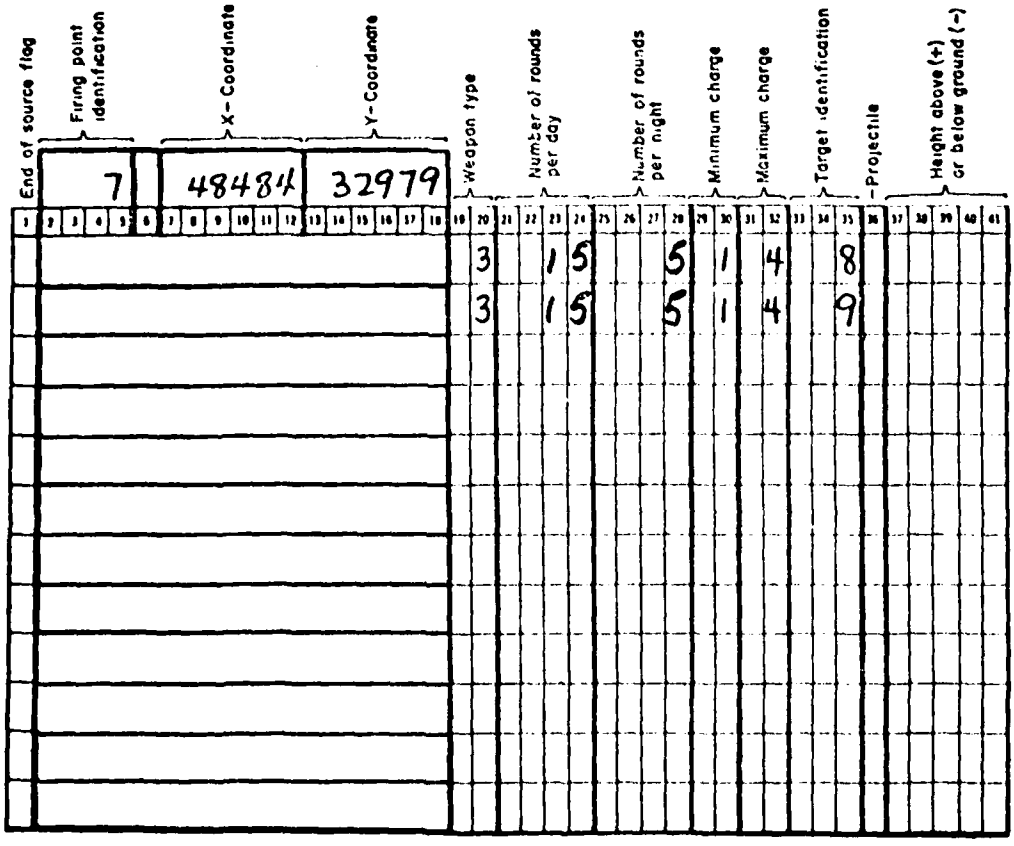

Figure 60. Firing point data form showing division of target groups.

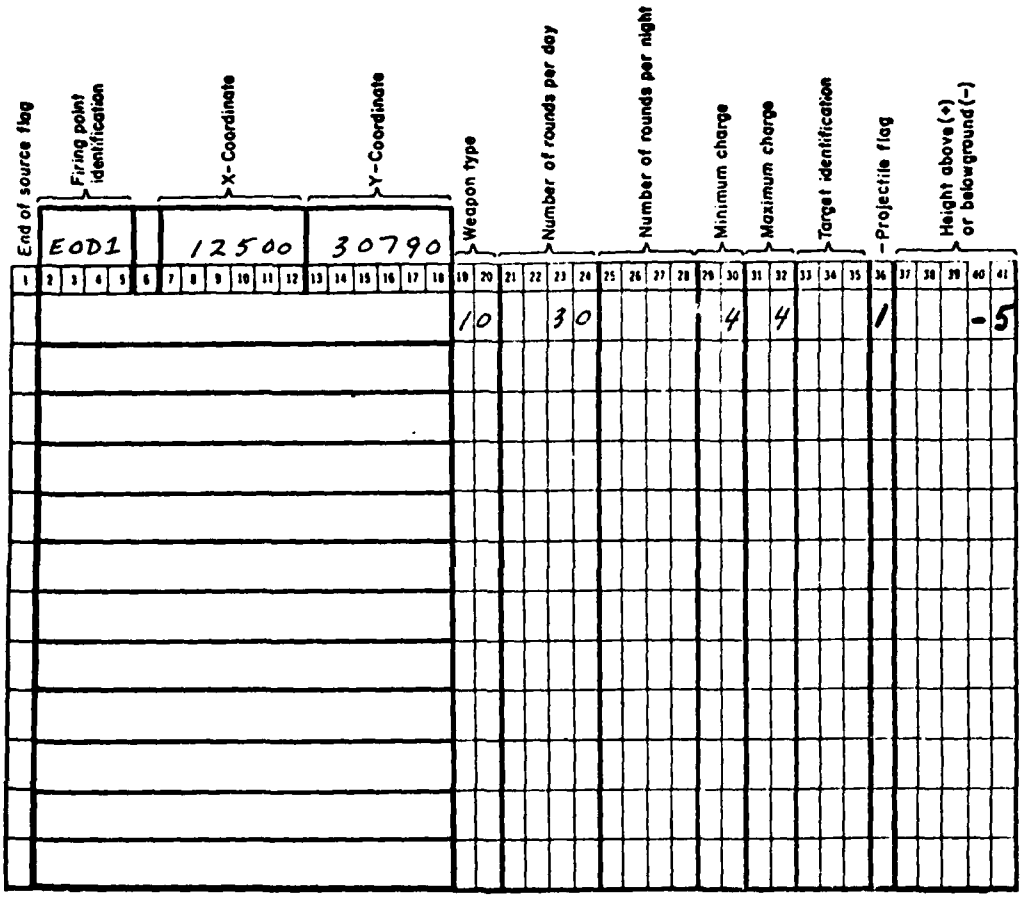

Figure 61. Firing point data form with height below ground entered.

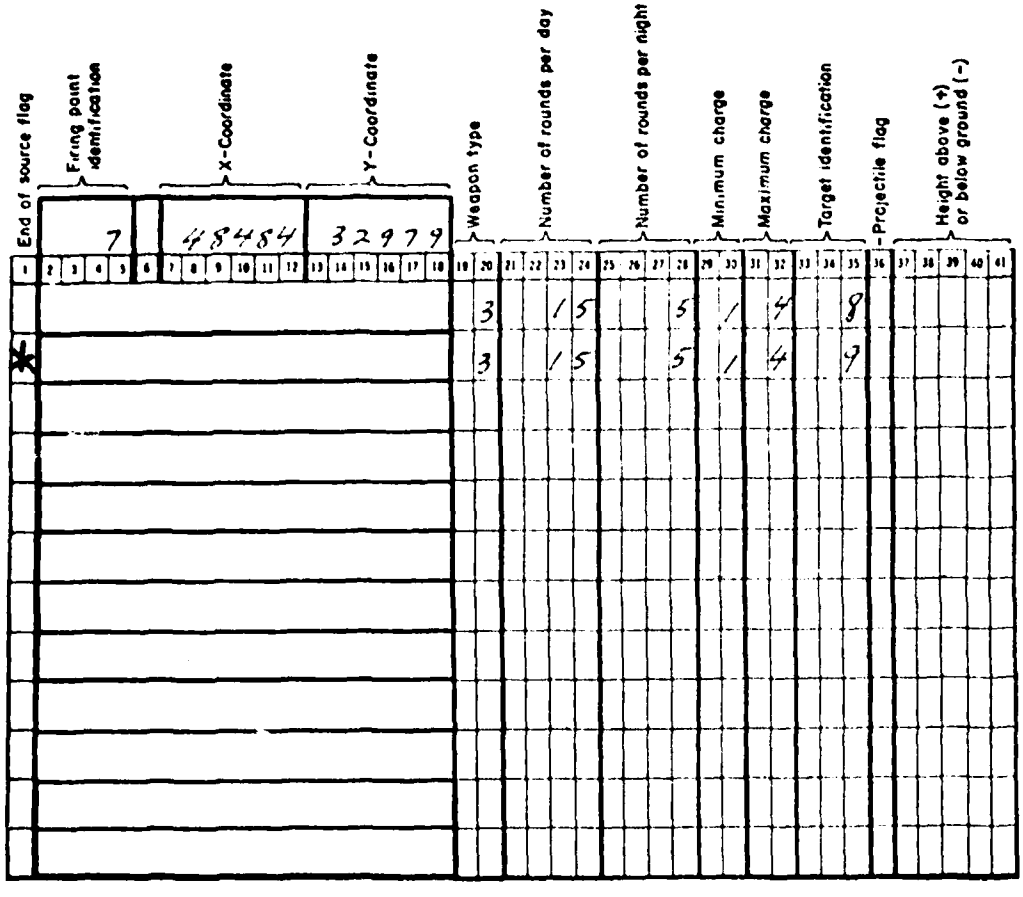

Figure 62. Completed firing point data form.

FUZE FUNCTION:
G = Ground Burst
NB = Non-Blast (WP, Illum, Smoke, etc.)
B = Below Ground Blast
A = Air Burst

DATE: ______________

UNIT: ______________ TARGET NAME: ______________

COLUMN NUMBER	WEAPON POSITION	TYPE WEAPON	NUMBER OF TUBES	CHG/ INCS	TARGET LOCATION	ROUNDS FIRED BY TIME PERIOD/FUZE FUNCTION					
						DAYTIME HOURS 0700-2200			NIGHTTIME HOURS 0000-0700 AND 2200-2400		
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A
						G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A	G,NB,B,A

Figure 63. Site form for gathering operational blast data.

Name of Person Preparing Work_____

Title_____

Office_____Phone_____

Signature:_____Phone_____

Approving Supervisor's Signature_____Date_____

Special Information:

1. Is this for an additional contour?_____

2. Hours during the day that firing occurs (or is predicted to occur) or percent of inversions_____

3. Day only firing option_____

   For response to 2 and 3, see Chapter 4. No response is necessary for the "normal" conditions.

4. Time Period Data Was Taken_____

General Information:

Locations Specified (feet or meters)_____

Weapon_____Code 15

Weapon_____Code 16

Weapon_____Code 17

Weapon_____Code 18

Weapon_____Code 19

Figure 64. Attachment sheet.

APPENDIX:

BRIEF INSTRUCTIONS FOR COMPLETING RECOMMENDED SITE FORMS

Site Forms/Weapons Fire

Figure 58 illustrates the site form which is recommended for gathering operational blast data. The units should fill out this form in the field. As mentioned in the body of the report, these forms can be submitted in place of the Firing Point Data Forms.

Use the following general guidelines for filling out the form:

1. Weapon position and target location are the same for 40-mm and 66-mm grenades, and hand grenades.

2. For COBRA-fired rockets and 40-mm grenades, both the firing point and target will be identified.

3. Air Force ordnance will be reported by target location for bombs and by firing point and target for rockets.

4. ICM rounds will be treated as ground burst.

5. The site form consists of seven major headings as well as unit identification and data information. The sections below describe each major heading:

Column Number. A number copied from the firing orders of the day or the problem number in a training situation.

Weapon Position. Either the firing point or mortar position local name from the map (i.e., FP101, range 5, etc.) or the location in Metric Grid Coordinates as read from the map or surveyor's stake.

Type Weapon. Weapon type.

Number of Tubes. Number of weapons actually firing that day on site.

CHG/INCS. The charge used or the number of increments of propellant added.

Target Number/Target Location. The number assigned to the target grouping nearest to the actual impact point or, if the installation did not group targets or cover the target impact area with target groupings, the Metric Grid Coordinates of the target impact. (For "fire for effect" missions, the accuracy of the data should be at least to the nearest kilometer.)

Round Fired by Time Period/Fuse Function. Pick the time period in which the firing took place. Enter the number of rounds in the appropriate box. Circle one of the following letters indicating the type of projectile fired:

G - ground burst and ICM bursts

NB - non-blast (WP, ILLUM, smoke, blanks, etc.)

A - air burst

B - below-ground burst

Note: If more than one type of round was fired during a time period, use ditto marks in the preceding columns and enter the correct number of rounds by projectile type on the next line.

Site Forms/Demolitions.

Figure A1 illustrates a form recommended for gathering operational data on blasting activities. The units should fill out this form in the field.

As stated in the body of the report, the number of shots fired is more important than the weight of charge. It should be determined whether there was one big blast or several smaller blasts. Also, for the purposes of this survey, each hole is to be considered as a different shot even if all holes are connected with detonator cord.

The site form for demolition activities consists of six major headings as well as unit identification and date information. The sections below describe each major heading:

Time

The time the explosion took place (use military time).

Location

Metric Grid Coordinate and, if possible, the common name of the area. Grid can be taken from the Range Bulletin if located by firing point.

Explosive Weight/Each

The amount of C4 or its equivalent in each hole or included in each shot. If a dud round is being destroyed, the equivalent weight of explosive in the round should be added to the unit's explosive used.

UNIT:_____

DATE:_____

TIME	LOCATION	EXPLOSIVE WEIGHT /EACH	NO. OF SHOTS	DEPTH	REMARKS

Figure A1. Site form for gathering operational blast data (demolition activities).

Number of Shots

The number of blast-like events. If there were 10 shots all using 4 lb of C4 within a few hours of each other, then a new line would not have to be started for each shot.

Depth

The depth below ground level of the explosive (in feet).

Remarks

Comment on ground type if it is not typical for the area. Also describe the type of exercise being performed (ACR, Range Sweep, Target Move, Road Sweep, Destruction of Evidence, Off-Post Incident No.____, Explosive Class, etc.)

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